EXHIBIT I

AO 120 (Rev. 08/10)

TO:	Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of New York on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
19-cv-6617	11/23/2019	Eastern District of New York

PLAINTIFF	DEFENDANT
Rondevoo Technologies, LLC	Keen Eye, LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	~~See Complaint~~		
2	7,088,854		
3	7,254,266		
4	8,687,879		
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Douglas C. Palmer	L. Hong	12/16/2019

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

EXHIBIT I

A31 PTO/SB/66
OMB 0651-00XX
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

PETITION TO ACCEPT UNINTENTIONALLY DELAYED PAYMENT OF MAINTENANCE FEE IN AN EXPIRED PATENT (37 CFR 1.378(b))

Patent Number	Issue Date	Application Number	Filing Date	Docket Number (if applicable)
8687879	01-Apr-2014	13267879	06-Oct-2011	

CAUTION: Maintenance fee (and surcharge, if any) payment must correctly identify: (1) the patent number and (2) the application number of the actual U.S. application leading to issuance of that patent to ensure the fee(s) is/are associated with the correct patent. 37 CFR 1.366(c) and (d).

Applicants claims the following fee status:

(◉) Small Entity

( ) Micro Entity

( ) Regular Undiscounted

Applicants selects the following :

(◉) 3 1/2	( ) 7 1/2	( ) 11 1/2

PETITION FEE
The petition fee required by 37 CFR 1.17(m) (Fee Code 1558/2558) must be paid as a condition of accepting unintentionally delayed payment of the maintenance fee.

MAINTENANCE FEE (37 CFR 1.20(e)-(g))
The appropriate maintenance fee must be submitted with this petition.

STATEMENT
THE UNDERSIGNED CERTIFIES THAT THE DELAY IN PAYMENT OF THE MAINTENANCE FEE TO THIS PATENT WAS UNINTENTIONAL

PETITIONER(S) REQUEST THAT THE DELAYED PAYMENT OF THE MAINTENANCE FEE BE ACCEPTED AND THE PATENT REINSTATED

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

37 CFR 1.378(c) states: "Any petition under this section must be signed in compliance with 37 CFR 1.33(b)."

I certify, in accordance with 37 CFR 1.4(d)(4) that I am

(◉) An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application.

( ) An attorney or agent registered to practice before the Patent and Trademark Office

( ) A sole patentee

( ) A joint patentee; I certify that I am authorized to sign this submission on behalf of all the other patentees as evidenced by the power of attorney in the application

( ) A joint patentee; all of whom are signing this e-petition

( ) The assignee of record of the entire interest that qualifies as an authorized party under 37 CFR 1.33(b)

EXHIBIT I

A31 PTO/SB/66
OMB 0651-00XX
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Attorney			
A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature			
Signature	/Jayson Sohi/		
Name	Jayson Sohi	Registration Number	71670

EXHIBIT I

Electronic Patent Application Fee Transmittal

Application Number:	13267879
Filing Date:	06-Oct-2011
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Filer:	Jayson Singh Sohi
Attorney Docket Number:	1137-P001004

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
MAINTENANCE FEE DUE AT 3.5 YEARS	2551	1	800	800
PET. DELAY PYMT MAINTAIN PATENT IN FORCE	2558	1	1000	1000
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

EXHIBIT I

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1800**

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

In re Patent No. 8687879
Issue Date: April 1,2014
Application No. 13267879
Filed: October 6,2011
Attorney Docket No. 1137-P001004

:
:DECISION GRANTING PETITION
:UNDER 37 CFR 1.378(b)
:

This is a decision on the electronic petition, filed September 19,2019 ,under 37 CFR 1.378(b) to accept the unintentionally delayed payment of the 3.5 year maintenance fee for the above-identified patent.

The petition is **GRANTED**.

The maintenance fee is accepted, and the above-identified patent reinstated as of September 19,2019 . This decision also constitutes notice that the fee has been accepted. An electronic copy of the petition and this decision has been created as an entry in the Image File Wrapper. Nevertheless, petitioner should print and retain an independent copy.

Telephone inquiries related to this electronic decision should be directed to the Electronic Business Center at 1-866-217-9197.

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	37219924
Application Number:	13267879
Patent Number:	8687879
Confirmation Number:	3626
Petition Issued Date:	September 19,2019
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Jayson Singh Sohi
Filer Authorized By:	
Attorney Docket Number:	1137-P001004
Receipt Date:	19-SEP-2019
Filing Date:	06-OCT-2011
Time Stamp:	18:40:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1800
RAM confirmation Number	E20199II42504819
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

EXHIBIT I

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition automatically granted by EFS	petition-request.pdf	32615 d5eacc0ca4acd28bcbd7e3fd01f8ed99f590b0fa	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31996 053634742d95f78f6285108b221f96db6cf15faa	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	64611		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/267,879	04/01/2014	8687879	1137-P001004	3626

60984 7590 03/12/2014

Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Carl W. Cotman, Santa Ana, CA;
Charles F. Chubb, Irvine, CA;
Yoshiyuki Inagaki, Irvine, CA;
Brian Cummings, Irvine, CA;

EXHIBIT I

13267879 - GAU: 2668

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13267879
Filing Date	2011-10-06
First Named Inventor	COTMAN, Carl W.
Art Unit	2129
Examiner Name	
Attorney Docket Number	1134-P001004

	9	5748847		1998-05-05	Lo, James Ting-Ho	
	10	6480627		2002-11-12	Mathias et al.	
	11	6628823		2003-09-30	Holm	
	12	6718054		2004-04-06	Lorigo et al.	
	13	6813373		2004-11-02	Suri et al.	
	14	6993185		2006-01-31	Guo et al.	
	15	5642434		1997-06-24	Nakao et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020186882		2002-12-12	Cotman, et al	
	2	20010009590		~~2001-01-29~~ 07/2001	Holm, Jack M.	

Change(s) applied to document.
/M.F.O./
10/30/2013

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

60984 7590 09/06/2013
Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004	3626

TITLE OF INVENTION: METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$890	$300	$0	$1190	12/06/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
ALAVI, AMIR	2668	382-156000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 COTMAN IP LAW GROUP, PLC
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
☑ Issue Fee
☑ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 502689 (enclose an extra copy of this form).

EXHIBIT I

5. **Change in Entity Status** (from status indicated above)

- ❑ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Obi Iloputaife/ Date 02-26-2014

Typed or printed name OBI ILOPUTAIFE Registration No. 45677

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

EXHIBIT I

Electronic Patent Application Fee Transmittal

Application Number:	13267879
Filing Date:	06-Oct-2011
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Filer:	Obi Iloputaife
Attorney Docket Number:	1137-P001004

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pet. Revive Abandon App, Delay Pymt-Resp	2453	1	850	850
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

EXHIBIT I

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**850**

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Decision Date : February 26, 2014

In re Application of :

Carl Cotman

Application No : 13267879

Filed : 06-Oct-2011

Attorney Docket No : 1137-P001004

DECISION ON PETITION

UNDER CFR 1.137(a)

This is an electronic decision on the petition under 37 CFR 1.137(a), filed February 26, 2014 , to revive the above-identified application.

The petition is **GRANTED.**

The above-identified application became abandoned for failure to reply in a timely manner to the Notice of Allowance and Issue Fee(s) Due. The date of abandonment is the day after the expiration date of the period set for reply in the Notice.

The electronic petition satisfies the conditions for revival pursuant to the provisions of 37 CFR 1.137(a) in that (1) the reply in the form of payment of the Issue Fee and the Publication Fee (if necessary); (2) the petition fee as set forth in 37 CFR 1.17 (m); (3) the drawing correction and/or other deficiencies (if necessary); and (4) the required statement of unintentional delay have been received. Accordingly, the Issue Fee payment is accepted as having been unintentionally delayed.

Telephone inquiries concerning this decision should be directed to the Patent Electronic Business Center (EBC) at 866-217-9197.

This application file is being directed to the Office of Data Management.

Office of Petitions

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	18306757
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Obi Iloputaife
Filer Authorized By:	
Attorney Docket Number:	1137-P001004
Receipt Date:	26-FEB-2014
Filing Date:	06-OCT-2011
Time Stamp:	13:39:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$850.0
RAM confirmation Number	15556
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

EXHIBIT I

1	Petition automatically granted by EFS	petition-request.pdf	31924 920eeef0b2ef6a143acd0cd349b40d127eedd95b	no	2
Warnings:					
Information:					
2	Issue Fee Payment (PTO-85B)	PTOL85B_1137-P001004.pdf	105573 08f9cd3f9ceacde73c816aa133ce98fbc8c8fc09	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30436 60d76e8e6b615a4d40102d211dd4a28c585ec33a	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	167933		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

Doc Code: PET.AUTO Document Description: Petition automatically granted by EFS-Web	PTO/SB/64 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	PETITION FOR REVIVAL OF AN APPLICATION FOR PATENT ABANDONED UNINTENTIONALLY UNDER 37 CFR 1.137(a)
Application Number	13267879
Filing Date	06-Oct-2011
First Named Inventor	Carl Cotman
Art Unit	2668
Examiner Name	AMIR ALAVI
Attorney Docket Number	1137-P001004
Title	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

The above-identified application became abandoned for failure to file a timely and proper reply to a notice or action by the United States Patent and Trademark Office. The date of abandonment is the day after the expiration date of the period set for reply in the office notice or action plus any extensions of time actually obtained.

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION

NOTE: A grantable petition requires the following items:
(1) Petition fee;
(2) Reply and/or issue fee;
(3) Terminal disclaimer with disclaimer fee – required for all utility and plant applications filed before June 8, 1995; and for all design applications;
(4) Statement that the entire delay was unintentional.

Petition Fee

◉ Small Entity	
○ Micro Entity	
○ Regular Undiscounted	

Issue Fee and Publication Fee :

Issue Fee and Publication Fee are not due.

☒ Issue Fee Transmittal is attached

Drawing corrections and/ or other deficiencies.

EXHIBIT I

◉ Drawing corrections and/ or other deficiencies are not required

○ I certify, in accordance with 37 CFR 1.4.(d)(4), that drawing corrections and/ or other deficiencies have previously been filed on

○ Drawing corrections and/ or other deficiencies are attached.

☒ STATEMENT: The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(a) was unintentional.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

◉ An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application.

○ An attorney or agent registered to practice before the Patent and Trademark Office, acting in a representative capacity.

○ A sole inventor

○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

○ A joint inventor; all of whom are signing this e-petition.

Signature	/Obi Iloputaife/
Name	Obi Iloputaife
Registration Number	45677

EXHIBIT I

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

60984 7590 09/06/2013
Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004	3626

TITLE OF INVENTION: METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$890	$300	$0	$1190	12/06/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
ALAVI, AMIR	2668	382-156000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 COTMAN IP LAW GROUP, PLC
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
☑ Issue Fee
☑ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 502689 (enclose an extra copy of this form).

02/27/2014 EEKUBAY2 00000038 502689 13267879

01 FC:2501 890.00 DA
02 FC:1504 300.00 DA

EXHIBIT I

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Obi Iloputaife/ Date 02-26-2014

Typed or printed name OBI ILOPUTAIFE Registration No. 45677

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

EXHIBIT I

Doc Code: PET.AUTO Document Description: Petition automatically granted by EFS-Web	PTO/SB/64 U.S. Patent and Trademark Office Department of Commerce
Electronic Petition Request	PETITION FOR REVIVAL OF AN APPLICATION FOR PATENT ABANDONED UNINTENTIONALLY UNDER 37 CFR 1.137(a)
Application Number	13267879
Filing Date	06-Oct-2011
First Named Inventor	Carl Cotman
Art Unit	2668
Examiner Name	AMIR ALAVI
Attorney Docket Number	1137-P001004
Title	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

The above-identified application became abandoned for failure to file a timely and proper reply to a notice or action by the United States Patent and Trademark Office. The date of abandonment is the day after the expiration date of the period set for reply in the office notice or action plus any extensions of time actually obtained.

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION

NOTE: A grantable petition requires the following items:
(1) Petition fee;
(2) Reply and/or issue fee;
(3) Terminal disclaimer with disclaimer fee – required for all utility and plant applications filed before June 8, 1995; and for all design applications;
(4) Statement that the entire delay was unintentional.

Petition Fee

- (•) Small Entity
- ( ) Micro Entity
- ( ) Regular Undiscounted

Issue Fee and Publication Fee:

Issue Fee and Publication Fee are not due.

☒ Issue Fee Transmittal is attached

Drawing corrections and/or other deficiencies.

02/26/2014 INTEFSW 00015556 13267879
01 FC:2453 850.00 OP

EXHIBIT I

◉ Drawing corrections and/ or other deficiencies are not required

○ I certify, in accordance with 37 CFR 1.4.(d)(4), that drawing corrections and/ or other deficiencies have previously been filed on

○ Drawing corrections and/ or other deficiencies are attached.

☒ STATEMENT: The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(a) was unintentional.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

◉ An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application.

○ An attorney or agent registered to practice before the Patent and Trademark Office, acting in a representative capacity.

○ A sole inventor

○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

○ A joint inventor; all of whom are signing this e-petition.

Signature	/Obi Iloputaife/
Name	Obi Iloputaife
Registration Number	45677

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004	3626

7590 12/26/2013

Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

EXAMINER	
ALAVI, AMIR	
ART UNIT	PAPER NUMBER
2668	
NOTIFICATION DATE	DELIVERY MODE
12/26/2013	ELECTRONIC

Notice of Abandonment

This application is abandoned in view of:

1. ☐ The applicant's failure to timely file a proper reply to the Office letter mailed on _____.
   (a) ☐ A reply was received on _____ (with a Certificate of Mailing or Transmission date _____), which is after the expiration of the period for reply (including a total extension of ____ month(s)) which expired on _____.
   (b) ☐ No reply has been received.
2. ☒ Applicant's failure to timely pay the required issue fee and publication fee, if applicable, within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85).
   (a) ☐ The issue fee and publication fee, if applicable, was received on _____ (with a Certificate of Mailing or Transmission date _____), which is after the expiration of the statutory period for payment of the issue fee (and publication fee) set in the Notice of Allowance (PTOL-85).
   (b) ☐ The submitted fee of $_____ is insufficient. A balance of $_____ is due.
   The issue fee required by 37 CFR 1.18 is $_____.
   The publication fee, if required by 37 CFR 1.18(d), is $_____.
   (c) ☒ The issue fee and publication fee, if applicable, has not been received.
3. ☐ Applicant's failure to timely file corrected drawings as required by, and within the three-month period set in, the Notice of Allowability (PTO-37).
   (a) ☐ Proposed corrected drawings were received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply.
   (b) ☐ No corrected drawing have been received.
4. ☐ Applicant's failure to timely file the inventor's oath or declaration no later than the date on which the issue fee was paid as required by the Notice Requiring Inventor's Oath or Declaration (PTO-2306).
   (a) ☐ An inventor's oath or declaration was received on _____ (with a Certificate of Mailing or Transmission date _____), which is after the date on which the issue fee was paid.
   (b) ☐ While an oath or declaration (or substitute statement) for one or more inventors was received, an oath or declaration (or substitute statement) for at least one other inventor has not been received.
   (c) ☐ No inventor's oath or declaration has been received.
5. ☐ Drawings received on _____ were disapproved by examiner. See examiner's response dated _____.
6. ☐ Corrected drawings were received on _____ , which is after the expiration of the one-month period for reply set in examiner's response dated _____.
7. ☐ No corrected drawings have been received in reply to one-month period set in examiner's response dated _____.
8. ☐ The reason(s) below:

Petitions to revive under 37 CFR 1.137(a) or (b), or request to withdraw the holding of abandonment under 37 CFR 1.181, should be promptly filed to minimize any negative effects on patent term.

/Almaz Gebeke/ for

(571)-272-4200 or 1(888)-786-0101
Patent Publication Branch
Office of Data Management

FORM PTO-ABN0 (Rev. 06/09)

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

60984 7590 09/06/2013

Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

EXAMINER
ALAVI, AMIR

ART UNIT	PAPER NUMBER
2668	

DATE MAILED: 09/06/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004	3626

TITLE OF INVENTION: METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$890	$300	$0	$1190	12/06/2013

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax **(571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

60984 7590 09/06/2013
Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004	3626

TITLE OF INVENTION: METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$890	$300	$0	$1190	12/06/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
ALAVI, AMIR	2668	382-156000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

EXHIBIT I

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29	NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
❑ Applicant asserting small entity status. See 37 CFR 1.27	NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
❑ Applicant changing to regular undiscounted fee status.	NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004	3626

60984 7590 09/06/2013

Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

EXAMINER	
ALAVI, AMIR	

ART UNIT	PAPER NUMBER
2668	

DATE MAILED: 09/06/2013

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

EXHIBIT I

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

EXHIBIT I

Notice of Allowability	Application No. 13/267,879	Applicant(s) COTMAN ET AL.	
	Examiner AMIR ALAVI	Art Unit 2668	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *The After Final amendment received on 08/27/2013*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are *8-21 (now renumbered as 1-14)*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____.
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.
5. ☒ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Amir Alavi/
Primary Examiner, Art Unit 2668

The present application is being examined under the pre-AIA first to invent provisions.

EXAMINER'S AMENDMENT

- An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.
- *The application has been amended as follows:*
- On the first page of the specification, line 3, after, "07/03/2007,", please insert, "now Abandoned".
- On the first page of the specification, line 4, after, "06/23/2006,", please insert, "now Patent number 7,254,266".
- On the first page of the specification, line 5, after, "04/25/2002,", please insert, "now Patent number 7,088,854".

REASONS FOR ALLOWANCE

- The following is an examiner's statement of reasons for allowance: The present invention pertains to varying embodiments for a non-transitory computer program product for automating the expert quantification of image data. The closest prior art, Gaborski et al. (USPN 5,479,523), shows a similar system, in which, methods and apparatus for constructing a classification weights matrix for a pattern recognition system are provided which enable large system feature sets to be reduced and yield at least the same level of performance achieved using the large feature set. Methods and apparatus are also described for determining (evaluating) the classification efficiency of selected subsets of a given feature set. Further aspects of the invention are directed to: (a) methods and apparatus for constructing reduced element classification weights matrices utilizing a genetic search process to find the subset having a maximum classification efficiency; and (b) pattern recognition systems (including, in particular, character identification systems), which utilize classifiers constructed in accordance with the aforementioned aspects of the invention to actually perform pattern recognition. However, Gaborski et al. fail to address: "*for a computer-readable*

medium encoded with computer readable instructions executable by one or more computer processors to quantify image sets comprising a locked evolving algorithm, wherein said locked evolving algorithm is generated by: obtaining a product algorithm for analysis of a first set of image data wherein said product algorithm is configured to recognize at least one entity within said first set of image data via a training mode that utilizes iterative input to an evolving algorithm obtained from at least one first user, wherein said training mode comprises: presenting a first set of said at least one entity to said user for feedback as to the accuracy of said first set of identified entities; obtaining said feedback from said user; executing said evolving algorithm using said feedback; presenting a second set of said at least one entity to said user for feedback as to the accuracy of said second set of identified entities; obtaining approval from said user about said second set of entities and storing said evolving algorithm as a product algorithm". These distinct features have been added to both independent claims and renders them allowable.

- Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

- Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMIR ALAVI whose telephone number is (571)272-7386. The examiner can normally be reached on Mon-Friday. 8:30 am thru 5:00pm.
- If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vu Le can be reached on 571-272-7332. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.
- Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov.

- Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Amir Alavi/
Primary Examiner, Art Unit 2668
Sunday, September 01, 2013

EXHIBIT I

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13267879	COTMAN ET AL.
	Examiner	**Art Unit**
	AMIR ALAVI	2668

CPC

Symbol			Type	Version
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CPC Combination Sets

Symbol			Type	Set	Ranking	Version
	/					
	/					

		Total Claims Allowed:	
NONE (Assistant Examiner)	(Date)	14	
/AMIR ALAVI/ Primary Examiner.Art Unit 2668 (Primary Examiner)	09/01/2013 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 2

EXHIBIT I

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13267879	COTMAN ET AL.
	Examiner	**Art Unit**
	AMIR ALAVI	2668

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
382	156	G	0	6	K	9 / 62 (2006.01.01)	G	0	6	K	9 / 00 (2006.01.01)

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	14	
/AMIR ALAVI/ Primary Examiner.Art Unit 2668	09/01/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

EXHIBIT I

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13267879	COTMAN ET AL.
	Examiner	**Art Unit**
	AMIR ALAVI	2668

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	14	17												
	2	6	18												
	3	7	19												
	4	8	20												
	5	9	21												
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	7														
1	8														
2	9														
3	10														
4	11														
5	12														
10	13														
11	14														
12	15														
13	16														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/AMIR ALAVI/ Primary Examiner.Art Unit 2668	09/01/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

EXHIBIT I

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13267879	COTMAN ET AL.
	Examiner	Art Unit
	AMIR ALAVI	2668

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
382	156,159,162,164,165,173,181,224	11/15/2012	A.A.
358	515,518	11/15/2012	A.A.
345	589,593,653,654,664,665	11/15/2012	A.A.
706	14,25,31	11/15/2012	A.A.
714	26,38	11/15/2012	A.A.
600	300	11/15/2012	A.A.
Above Updated		04/30/2013	A.A.
Above Updated		09/01/2013	A.A.

SEARCH NOTES		
Search Notes	Date	Examiner
East & IEEE	11/15/2012	A.A.
Inventor name & Assignee search	11/15/2012	A.A.
Double Patenting search	11/15/2012	A.A.
Interference search history printout	09/01/2013	A.A.

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

EXHIBIT I

INTERFERENCE SEARCH			
US Class/ CPC Symbol	**US Subclass / CPC Group**	**Date**	**Examiner**
382	156	09/01/2013	A.A.
PGPUB text searched		09/01/2013	A.A.
Interference search history		09/01/2013	A.A.

EXHIBIT I

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	13/267,879	Confirmation No.: 3626
Applicant:	Carl W. Cotman et al.	
Filed:	10/6/2011	
TC/A.U.:	2668	
Examiner:	ALAVI, Amir	
Docket:	1137-P001004	
Customer No.:	60984	
For:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS	

Commissioner for Patents
via EFSWeb

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

In response to the Office Action of May 3, 2013, please amend the application as detailed herein. The Commissioner is hereby authorized to use deposit account 502689 for any other charges not accounted for herein. Please reference our file number 1137-P001004 when using the deposit account and on all other correspondence.

Remarks/Arguments begin on page **2** of this paper.

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P O Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 3626

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/267,879	10/06/2011 RULE	382	2668	1137-P001004

APPLICANTS

Carl W. Cotman, Santa Ana, CA;
Charles F. Chubb, Irvine, CA;
Yoshiyuki Inagaki, Irvine, CA;
Brian Cummings, Irvine, CA;

**** CONTINUING DATA ***************************

This application is a CON of 11/773,289 07/03/2007 ABN
which is a CON of 11/474,064 06/23/2006 PAT 7254266
which is a DIV of 10/134,157 04/25/2002 PAT 7088854
which claims benefit of 60/286,897 04/25/2001

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
10/20/2011

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ Yes ☑ No	☐ Yes ☑ No	/AMIR ALAVI/ Examiner's Signature	☐ Initials	CA	15	6	2

ADDRESS

Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105
UNITED STATES

TITLE

METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
595	No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

EXHIBIT I

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	(locked adj evolving)and(training adj mode$2)and(iterative)	US-PGPUB; USPAT	AND	ON	2013/09/01 18:02

9/ 1/ 2013 6:03:16 PM
C:\ Users\ aalavi\ Documents\ EAST\ Workspaces\ 12205921.wsp

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004

CONFIRMATION NO. 3626

60984
Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

POA ACCEPTANCE LETTER

OC000000063464166

Date Mailed: 08/30/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/16/2013.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/nfissha/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

EXHIBIT I

Doc Code: DIST.E.FILE
Document Description: Electronic Terminal Disclaimer - Filed

PTO/SB/26
U.S. Patent and Trademark Office
Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	13267879
Filing Date	06-Oct-2011
First Named Inventor	Carl Cotman
Attorney Docket Number	1137-P001004
Title of Invention	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
Inventors Carl W. Cotman, Charles F. Chubb, Yoshiyuki Inagaki, and Brian Cummings	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

7254266

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◯ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

EXHIBIT I

◉ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number 45677 ○ A sole inventor ○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors ○ A joint inventor; all of whom are signing this request ○ The assignee of record of the entire interest that has properly made itself of record pursuant to 37 CFR 3.71	
Signature	/OI45677/
Name	Obi Iloputaife

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

EXHIBIT I

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 13267879

Filing Date: 06-Oct-2011

Applicant/Patent under Reexamination: Cotman et al.

Electronic Terminal Disclaimer filed on August 27, 2013

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	16695959
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Obi Iloputaife
Filer Authorized By:	
Attorney Docket Number:	1137-P001004
Receipt Date:	27-AUG-2013
Filing Date:	06-OCT-2011
Time Stamp:	13:35:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Electronic Terminal Disclaimer-Filed	eTerminal-Disclaimer.pdf	32353 807a8a25e6f886074ee3ef38e28dlf84e151b1561	no	2

Warnings:	
Information:	

EXHIBIT I

Total Files Size (in bytes):	32353

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	13/267,879	Confirmation No.: 3626
Applicant:	Carl W. Cotman et al.	
Filed:	10/6/2011	
TC/A.U.:	2668	
Examiner:	ALAVI, Amir	
Docket:	1137-P001004	
Customer No.:	60984	
For:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS	

Commissioner for Patents
via EFSWeb

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

In response to the Office Action of May 3, 2013, please amend the application as detailed herein. The Commissioner is hereby authorized to use deposit account 502689 for any other charges not accounted for herein. Please reference our file number 1137-P001004 when using the deposit account and on all other correspondence.

Remarks/Arguments begin on page **2** of this paper.

REMARKS/ARGUMENTS

Claims 8-21 are pending in the present application. No claims have been amended. The Examiner has stated he "will look forward to receive further amendments addressing the above issue and to expedite allowance of this application." Applicant submits that the Terminal Disclaimer issue addressed by the Examiner has been resolved, as indicated in the attached electronic filing receipt.

For at least the reasons stated herein, Applicant asserts that the filing of the Terminal Disclaimer puts the claims in condition for allowance.

Double Patenting Rejections

The Examiner rejects claims 8-21 for double patenting over U.S. Patent No. 7,254,266. Applicant has filed a terminal disclaimer to overcome the Examiner's non-statutory double patenting rejection of claims 8-21 over U.S. Patent No. 7,254,266. Applicant respectfully requests reconsideration and withdrawal of this rejection.

Conclusion

Applicant asserts that the claims as presented in condition for allowance with filing of the Terminal Disclaimer. Applicant respectfully requests a timely Notice of Allowance for the claims in this case.

Respectfully submitted,

/OI45677/

Obi Iloputaife, Reg. No.: 45677
Cotman IP Law Group, PLC

EXHIBIT I

Tel. (626) 405-1413
Fax (626) 628-0404

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	16695959
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Obi Iloputaife
Filer Authorized By:	
Attorney Docket Number:	1137-P001004
Receipt Date:	27-AUG-2013
Filing Date:	06-OCT-2011
Time Stamp:	13:35:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Electronic Terminal Disclaimer-Filed	eTerminal-Disclaimer.pdf	32353 807a8a25e6f886074ee3ef38e28dlf84e151b1561	no	2

Warnings:	
Information:	

EXHIBIT I

Total Files Size (in bytes):	32353

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 13267879

Filing Date: 06-Oct-2011

Applicant/Patent under Reexamination: Cotman et al.

Electronic Terminal Disclaimer filed on August 27, 2013

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

EXHIBIT I

Electronic Patent Application Fee Transmittal

Application Number:	13267879
Filing Date:	06-Oct-2011
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Filer:	Obi Iloputaife
Attorney Docket Number:	1137-P001004

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with $0 paid	2251	1	100	100

EXHIBIT I

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**100**

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	16696441
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Obi Iloputaife
Filer Authorized By:	
Attorney Docket Number:	1137-P001004
Receipt Date:	27-AUG-2013
Filing Date:	06-OCT-2011
Time Stamp:	14:00:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$100
RAM confirmation Number	292
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

EXHIBIT I

1	Extension of Time	aia0022_EOT_1137-P001004.pdf	169485 badb08c667eb0cc08c6540af07e508b0130dfb55	no	2
Warnings:					
Information:					
2	Response After Final Action	RFOA_1137-P001004.pdf	118726 9f63be2e76bdc56a2cc2b7908ef3e48830120480	no	6
Warnings:					
The PDF file has been signed with a digital signature and the legal effect of the document will be based on the contents of the file not the digital signature.					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30558 22f69b9b95022a8ee3c36f2ef7687eff54bff1a1	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	318769		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

PTO/AIA/22 (03-13)
Approved for use through 3/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): 1137-P001004

Application Number: 13/267,879

Filed: 2011-10-06

For: METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

Art Unit: 2668

Examiner: ALAVI, Amir

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	Micro Entity Fee	
☑	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$ 100
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☐	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☑ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 502689.

☑ Payment made via EFS-Web.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 45677.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/OI45677/	08-27-2013
Signature	Date
Obi Iloputaife	626-405-1413
Typed or printed name	Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☑ * Total of 1 forms are submitted.

EXHIBIT I

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

EXHIBIT I

PTO/SB/81 (01-09)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	13/267,879
Filing Date	10/6/2011
First Named Inventor	Carl W. Cotman
Title	METHOD AND APPARATUS FOR GENERATING SPECIAL
Art Unit	2668
Examiner Name	Amir Alavi
Attorney Docket Number	1137-P001004

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 60984

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☐ The address associated with the above-mentioned Customer Number.

OR

☒ The address associated with Customer Number: 60984

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☒ Applicant/Inventor.

OR

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature	C. F. Chubb	Date	July 23, 2013
Name	Charles F. Chubb	Telephone	949-824-1481
Title and Company			

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 4 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

EXHIBIT I

PTO/SB/81 (01-09)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	13/267,879
Filing Date	10/6/2011
First Named Inventor	Carl W. Colman
Title	METHOD AND APPARATUS
Art Unit	2668
Examiner Name	Amir Alavi
Attorney Docket Number	1137-P001004

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

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Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☐ The address associated with the above-mentioned Customer Number.

OR

☒ The address associated with Customer Number: 60984

OR

☐ Firm or Individual Name	
Address	
City / State / Zip	
Country	
Telephone / Email	

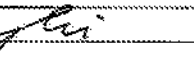
I am the:

☒ Applicant/Inventor.

OR

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature		Date	9/25/13
Name	Yoshiyuki Inagaki	Telephone	949-824-3254
Title and Company	Research Scientist, Yahoo! Inc.		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 4 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

EXHIBIT I

PTO/SB/81 (01-08)
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U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	13/267,879
Filing Date	10/6/2011
First Named Inventor	Carl W. Cotman
Title	METHOD AND APPARATUS FOR GENERATING SPECIAL
Art Unit	2868
Examiner Name	Amir Alavi
Attorney Docket Number	1137-P001004

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

60984

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☐ The address associated with the above-mentioned Customer Number.

OR

☒ The address associated with Customer Number: 60984

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☒ Applicant/Inventor.

OR

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature	Carl W. Cotman	Date	8/13/13
Name	Carl W. Cotman	Telephone	
Title and Company			

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 4 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

EXHIBIT I

PTO/SB/61 (01-09)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	13/267,879
Filing Date	10/6/2011
First Named Inventor	CARL W. COTMAN
Title	METHOD AND APPARATUS FOR
Art Unit	2668
Examiner Name	AMIR ALAVI
Attorney Docket Number	1127-P001004

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 60984

OR

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Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☐ The address associated with the above-mentioned Customer Number.

OR

☒ The address associated with Customer Number: 60984

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☒ Applicant/Inventor.

OR

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____.

SIGNATURE of Applicant or Assignee of Record

Signature		Date	7/28/13
Name	BRIAN CUMMINGS	Telephone	
Title and Company			

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 4 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	16616533
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Obi Iloputaife/Soseh Moghoyan
Filer Authorized By:	Obi Iloputaife
Attorney Docket Number:	1137-P001004
Receipt Date:	16-AUG-2013
Filing Date:	06-OCT-2011
Time Stamp:	18:33:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	cotmanpoas.pdf	1371489 23254c576eda1c0b4a7b1535e81c89672347c39a	no	4

Warnings:	
Information:	

EXHIBIT I

Total Files Size (in bytes):	1371489

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004

CONFIRMATION NO. 3626

IMPROPER CPOA LETTER

60984
Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

OC000000061210588

Date Mailed: 05/15/2013

NOTICE REGARDING POWER OF ATTORNEY

This is in response to the power of attorney filed 05/03/2013. The power of attorney in this application is not accepted for the reason(s) listed below:

- The signature(s) of Charles F. Chubb, Yoshiyuki Inagaki, Brian Cummings, co-inventor(s) in this application, has/have been omitted. The power of attorney will be entered upon receipt of confirmation signed by said co-inventor(s).

/tnnguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004	3626

60984 7590 05/03/2013

Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

EXAMINER	
ALAVI, AMIR	

ART UNIT	PAPER NUMBER
2668	

NOTIFICATION DATE	DELIVERY MODE
05/03/2013	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@cotmanip.com

EXHIBIT I

Office Action Summary	Application No. 13/267,879	Applicant(s) COTMAN ET AL.	
	Examiner AMIR ALAVI	Art Unit 2668	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 March 2013*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *8-21* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *8-21* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *06 October 2011* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some * c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Interim copies:

a)☐ All b)☐ Some c)☐ None of the: Interim copies of the priority documents have been received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

4) ☐ Other: _____.

Response to Amendment

- Applicant's amendment filed on 21 March 2013 has been entered and made of record.
- The TD was disapproved by the Patent Legal Research Center because, "*The person who signed the TD does not have POA, 3.73(b) statement and thus not attorney of record, see FP 14.29.01 and 14.30*"; "*Also resubmit TD with these papers, no Fee is required*".
- Therefore, at this stage this Office Action is being made FINAL.
- Nonetheless, Examiner will look forward to receive further amendments addressing the above issue and to expedite allowance of this application.

Double Patenting

- The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

- A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.
- Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).
- *Claims 8-21 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-6 of U.S. Patent No. 7,254,266.* Although the conflicting claims are not identical, they are not patentably distinct from each other because the claim limitations of the instant invention are anticipated by the above mention U.S. Patent.

- Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMIR ALAVI whose telephone number is (571)272-7386. The examiner can normally be reached on Mon-Friday. 8:30 am thru 5:00pm.
- If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vu Le can be reached on 571-272-7332. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.
- Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov.

EXHIBIT I

- Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Amir Alavi/
Primary Examiner, Art Unit 2668
Tuesday, April 30, 2013

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P O Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 3626

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/267,879	10/06/2011 RULE	382	2668	1137-P001004

APPLICANTS

Carl W. Cotman, Santa Ana, CA;
Charles F. Chubb, Irvine, CA;
Yoshiyuki Inagaki, Irvine, CA;
Brian Cummings, Irvine, CA;

**** CONTINUING DATA ***************************

This application is a CON of 11/773,289 07/03/2007 ABN
which is a CON of 11/474,064 06/23/2006 PAT 7254266
which is a DIV of 10/134,157 04/25/2002 PAT 7088854
which claims benefit of 60/286,897 04/25/2001

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
10/20/2011

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ Yes ☑ No	☐ Yes ☑ No	/AMIR ALAVI/ Examiner's Signature	☐ Initials	CA	15	6	2

ADDRESS

Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105
UNITED STATES

TITLE

METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
595	No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

EXHIBIT I

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13267879	COTMAN ET AL.
	Examiner	Art Unit
	AMIR ALAVI	2668

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	11/15/2012	04/30/2013							
	1	-	-							
	2	-	-							
	3	-	-							
	4	-	-							
	5	-	-							
	6	-	-							
	7	-	-							
	8	✓	✓							
	9	✓	✓							
	10	✓	✓							
	11	✓	✓							
	12	✓	✓							
	13	✓	✓							
	14	✓	✓							
	15	✓	✓							
	16	✓	✓							
	17	✓	✓							
	18	✓	✓							
	19	✓	✓							
	20	✓	✓							
	21	✓	✓							

EXHIBIT I

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13267879	COTMAN ET AL.
	Examiner	Art Unit
	AMIR ALAVI	2668

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
382	156,159,162,164,165,173,181,224	11/15/2012	A.A.
358	515,518	11/15/2012	A.A.
345	589,593,653,654,664,665	11/15/2012	A.A.
706	14,25,31	11/15/2012	A.A.
714	26,38	11/15/2012	A.A.
600	300	11/15/2012	A.A.
Above Updated		04/30/2013	A.A.

SEARCH NOTES		
Search Notes	Date	Examiner
East & IEEE	11/15/2012	A.A.
Inventor name & Assignee search	11/15/2012	A.A.
Double Patenting search	11/15/2012	A.A.

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

EXHIBIT I

PTO/SB/81 (01-09)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	11/773,289
Filing Date	7/3/2007
First Named Inventor	COTMAN
Title	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE...
Art Unit	2624
Examiner Name	Not yet assigned
Attorney Docket Number	1137-P001003

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 60984

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☒ The address associated with the above-mentioned Customer Number.

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☒ Applicant/Inventor.

OR

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature	Carl W Cotman	Date	4/10/11
Name	Carl W. Cotman	Telephone	714.885.5843
Title and Company			

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	15688614
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Obi Iloputaife/Soseh Moghoyan
Filer Authorized By:	Obi Iloputaife
Attorney Docket Number:	1137-P001004
Receipt Date:	03-MAY-2013
Filing Date:	06-OCT-2011
Time Stamp:	16:21:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	11773289.pdf	50565 331b5c7b57de9301271c1a113fd1f055ad6308a	no	1

Warnings:	
Information:	

EXHIBIT I

Total Files Size (in bytes):	50565

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	13/267,879	COTMAN ET AL.	

Document Code - DISQ	Internal Document – DO NOT MAIL

TERMINAL DISCLAIMER	☐ APPROVED	☒ DISAPPROVED
Date Filed : 3/21/13	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:

Td disapproved.

The person who signed the Td does not have POA, 3.73(b) statement and thus not attny of record, see FP 14.29.01 and 14.30.

Also resubmit Td with these papers, NO Fee is required.

Lawana Hixon

EXHIBIT I

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	13/267,879	Conf. No.:	3626
Applicant:	Carl W. Cotman et al.		
Filed:	10/6/2011		
TC/A.U.:	2668		
Examiner:	ALAVI, Amir		
Docket:	1137-P001004		
Customer No.:	60984		
For:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS		

Commissioner for Patents
via EFSWeb

AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION

Sir:

In response to the Office Action of November 20, 2012, please amend the application as detailed herein. The Commissioner is hereby authorized to use deposit account 502689 for any other charges not accounted for herein. Please reference our file number 1137-P001004 when using the deposit account and on all other correspondence.

REMARKS/ARGUMENTS

Claims 8-21 are pending in the present application. No claims have been amended.

For at least the reasons stated herein, Applicant asserts that the claims as presented are patentable over the cited art and are therefore in condition for allowance.

Double Patenting Rejections

The Examiner rejects claims 8-21 for double patenting over U.S. Patent No. 7,254,266. Applicant has filed a terminal disclaimer along with this response to overcome the Examiner's non-statutory double patenting rejection of claims 8-21 over U.S. Patent No. 7,254,266. Applicant respectfully requests reconsideration and withdrawal of this rejection.

Conclusion

Applicant asserts that the claims as presented in condition for allowance with filing of the Terminal Disclaimer enclosed herewith. Applicant respectfully requests a timely Notice of Allowance for the claims in this case.

Respectfully submitted,

/OI45677/

Obi Iloputaife, Reg. No.: 45677
Cotman IP Law Group, PLC
Tel. (626) 405-1413
Fax (626) 628-0404

EXHIBIT I

PTO/SB/26 (08-11)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	Docket Number (Optional) 1137.P001004

In re Application of: Carl W. Cotman et al

Application No.: 13/267,879

Filed: 10/6/2011

For: METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

The owner*, Inventors Cotman, Chubb, Inagaki & Cummings, of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of **prior patent** No. 7,254,266 as the term of said **prior patent** is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

expires for failure to pay a maintenance fee;
is held unenforceable;
is found invalid by a court of competent jurisdiction;
is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
has all claims canceled by a reexamination certificate;
is reissued; or
is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 45677

/OI45677/ — Signature
03/21/2013 — Date

OBI ILOPUTAIFE
Typed or printed name

626-405-1413
Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

EXHIBIT I

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

EXHIBIT I

PTO/SB/22 (10-12)
Approved for use through 1/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): 1137-P001004

Application Number: 13/267,879

Filed: 10/6/2011

For: METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

Art Unit: 2668

Examiner: ALAVI, Amir

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$150	$75	$
■ Two months (37 CFR 1.17(a)(2))	$570	$285	$ 285
☐ Three months (37 CFR 1.17(a)(3))	$1,290	$645	$
☐ Four months (37 CFR 1.17(a)(4))	$2,010	$1,005	$
☐ Five months (37 CFR 1.17(a)(5))	$2,730	$1,365	$

■ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☐ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number _____.

■ Payment made via EFS-Web.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71. 37 CFR 3.73(b) statement is enclosed (Form PTO/SB/96).

■ attorney or agent of record. Registration number 45677.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Ol45677/ — Signature

03/21/2013 — Date

Obi Iloputaife — Typed or printed name

626-405-1413 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

■ * Total of 1 forms are submitted.

EXHIBIT I

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

EXHIBIT I

Electronic Patent Application Fee Transmittal

Application Number:	13267879
Filing Date:	06-Oct-2011
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Filer:	Obi Iloputaife
Attorney Docket Number:	1137-P001004

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 2 months with $0 paid	2252	1	300	300

EXHIBIT I

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**300**

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	15318779
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Obi Iloputaife
Filer Authorized By:	
Attorney Docket Number:	1137-P001004
Receipt Date:	21-MAR-2013
Filing Date:	06-OCT-2011
Time Stamp:	12:34:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$300
RAM confirmation Number	11083
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

EXHIBIT I

1	Applicant Arguments/Remarks Made in an Amendment	ROA_1137-P001004.pdf	69403 89a1e8cb7b0893d8b2f95273bf7c6862008c2c45	no	2
Warnings:					
Information:					
2	Applicant Arguments/Remarks Made in an Amendment	sb0026_1137-P001004.pdf	374326 c56fd4dc73f700653b9b7845dc0324fa4fcfc91c	no	2
Warnings:					
Information:					
3	Extension of Time	sb0022_1137-P001004.pdf	82759 e103250fd830dc6f07a4ee0dd44bf5805c8cdce9	no	2
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30560 e8b28b1053f53787d342bf1f322d924b4f2d19e9	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	557048		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004	3626

60984 7590 11/20/2012

Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

EXAMINER	
ALAVI, AMIR	

ART UNIT	PAPER NUMBER
2668	

NOTIFICATION DATE	DELIVERY MODE
11/20/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@cotmanip.com

EXHIBIT I

Office Action Summary	Application No.	Applicant(s)	
	13/267,879	COTMAN ET AL.	
	Examiner	Art Unit	
	AMIR ALAVI	2668	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 October 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *8-21* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *8-21* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *06 October 2011* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

4) ☐ Other: _____.

DETAILED ACTION

Double Patenting

- The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

- A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.
- Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).
- *Claims 8-21 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-6 of U.S. Patent No. 7,254,266.* Although the conflicting claims are not identical, they are not patentably distinct from each other because the claim limitations of the instant invention are anticipated by the above mention U.S. Patent.

- Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMIR ALAVI whose telephone number is (571)272-7386. The examiner can normally be reached on Mon-Friday. 8:30 am thru 5:00pm.
- If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vu Le can be reached on 571-272-7332. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.
- Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov.

- Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Amir Alavi/
Primary Examiner, Art Unit 2668
Thursday, November 15, 2012

EXHIBIT I

Notice of References Cited	Application/Control No. 13/267,879	Applicant(s)/Patent Under Reexamination COTMAN ET AL.	
	Examiner AMIR ALAVI	Art Unit 2668	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2008/0107330	05-2008	Cotman et al.	382/156
*	B	US-2012/0121169	05-2012	Cotman et al.	382/156
*	C	US-7,254,266	08-2007	Cotman et al.	382/156
*	D	US-5,479,523	12-1995	Gaborski et al.	382/159
*	E	US-5,555,317	09-1996	Anderson, Peter G.	382/159
*	F	US-7,783,085	08-2010	Perlmutter et al.	382/118
*	G	US-7,152,051	12-2006	Commons et al.	706/16
*	H	US-6,090,044	07-2000	Bishop et al.	600/300
*	I	US-5,919,267	07-1999	Urnes et al.	714/26
*	J	US-5,748,847	05-1998	Lo, James Ting-Ho	706/14
*	K	US-7,088,854	08-2006	Cotman et al.	382/165
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EXHIBIT I

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13267879
Filing Date	2011-10-06
First Named Inventor	COTMAN, Carl W.
Art Unit	2129 2668
Examiner Name	Alavi
Attorney Docket Number	1134-P001004

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7254266		2007-08-07	Cotman et al.	
	2	7088854		2006-08-08	Cotman et al.	
	3	5479523		1995-12-26	Gaborski et al.	
	4	5555317		1996-09-10	Anderson, Peter G.	
	5	7783085		2010-08-24	Perlmutter et al.	
	6	7152051		2006-12-19	Commons et al.	
	7	6090044		2000-07-18	Bishop et al.	
	8	5919267		1999-07-06	Umes et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

EXHIBIT I

Application Number	13267879
Filing Date	2011-10-06
First Named Inventor	COTMAN, Carl W.
Art Unit	2129
Examiner Name	
Attorney Docket Number	1134-P001004

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

	9	5748847		1998-05-05	Lo, James Ting-Ho	
	10	6480627		2002-11-12	Mathias et al.	
	11	6628823		2003-09-30	Holm	
	12	6718054		2004-04-06	Lorigo et al.	
	13	6813373		2004-11-02	Suri et al.	
	14	6993185		2006-01-31	Guo et al.	
	15	5642434		1997-06-24	Nakao et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020186882		2002-12-12	Cotman, et al	
	2	20010009590		2001-01-29	Holm, Jack M.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

EXHIBIT I

13267879 - GAU: 2668

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13267879
Filing Date	2011-10-06
First Named Inventor	COTMAN, Carl W.
Art Unit	2129
Examiner Name	
Attorney Docket Number	1134-P001004

	3	20080107330		2008-05-08	Cotman et al	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/Amir Alavi/	Date Considered	11/15/2012

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

EXHIBIT I

13267879 - GAU: 2668

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13267879
Filing Date	2011-10-06
First Named Inventor	COTMAN, Carl W.
Art Unit	2129
Examiner Name	
Attorney Docket Number	1134-P001004

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/EW64327/	Date (YYYY-MM-DD)	2012-03-21
Name/Print	ELLEN WEI	Registration Number	64327

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

EXHIBIT I

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A./

EXHIBIT I

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13267879	COTMAN ET AL.
	Examiner	Art Unit
	AMIR ALAVI	2668

SEARCHED

Class	Subclass	Date	Examiner
382	156,159,162,164,165,173,181,224	11/15/2012	A.A.
358	515,518	11/15/2012	A.A.
345	589,593,653,654,664,665	11/15/2012	A.A.
706	14,25,31	11/15/2012	A.A.
714	26,38	11/15/2012	A.A.
600	300	11/15/2012	A.A.

SEARCH NOTES

Search Notes	Date	Examiner
East & IEEE	11/15/2012	A.A.
Inventor name & Assignee search	11/15/2012	A.A.
Double Patenting search	11/15/2012	A.A.

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

EXHIBIT I

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13267879	COTMAN ET AL.
	Examiner	Art Unit
	AMIR ALAVI	2668

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	11/15/2012								
	1	-								
	2	-								
	3	-								
	4	-								
	5	-								
	6	-								
	7	-								
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	18	✓								
	19	✓								
	20	✓								
	21	✓								

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P O Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 3626

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/267,879	10/06/2011	382	2668	1137-P001004

APPLICANTS

Carl W. Cotman, Santa Ana, CA;
Charles F. Chubb, Irvine, CA;
Yoshiyuki Inagaki, Irvine, CA;
Brian Cummings, Irvine, CA;

**** CONTINUING DATA ***************************

This application is a CON of 11/773,289 07/03/2007 ABN
which is a CON of 11/474,064 06/23/2006 PAT 7,254,266
which is a DIV of 10/134,157 04/25/2002 PAT 7,088,854
which claims benefit of 60/286,897 04/25/2001

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
10/20/2011

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /AMIR ALAVI/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CA	15	6	2

ADDRESS

Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105
UNITED STATES

TITLE

METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

FILING FEE RECEIVED		
595	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

EXHIBIT I

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2	"20120121169".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/15 09:38
L2	35	("5642434" | "5748847" | "6718054" | "20080107330" | "7254266" | "20080107330" | "7254266" | "6628823" | "5555317" | "6628823" | "5479523" | "5919267" | "7088854" | "5748847" | "6993185" | "20020186882" | "5479523" | "6480627" | "6813373" | "7783085" | "20020186882" | "7152051" | "7783085" | "7152051" | "5642434" | "6480627" | "6718054" | "20010009590" | "20010009590" | "6090044" | "6813373" | "7088854" | "5919267" | "6090044" | "6993185" | "5555317").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/15 09:39

11/15/2012 11:04:18 AM
C:\Users\aalavi\Documents\EAST\Workspaces\12205921.wsp

EXHIBIT I

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	13/267,879	COTMAN ET AL.	

Document Code - DISQ	Internal Document – DO NOT MAIL

TERMINAL DISCLAIMER	☐ APPROVED	☒ DISAPPROVED
Date Filed : 04/23/12	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:

The person who signed the Td does not have POA, 3.73(b) statement and thus not attny of record, see FP 14.29.01 and 14.30.

Also resubmit Td with these papers, NO FEE is required.

Angie Walker

EXHIBIT I

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004

CONFIRMATION NO. 3626

60984
Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

PUBLICATION NOTICE

OC000000054330993

Title:METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

Publication No.US-2012-0121169-A1
Publication Date:05/17/2012

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

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Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

EXHIBIT I

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.: 13/267,879

Applicant: Carl W. Cotman et al.

Filed: 10/6/2011

Docket: 1137-P001004

Customer No.: 60984

Conf. No.: 3626

For: METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

Commissioner for Patents
via EFSWeb

PRELIMINARY AMENDMENT

Dear Sir:

This Preliminary Amendment is hereby presented before first action. Please amend the application referenced above as follows:

Amendments to the Claims begin on page **2** of this paper.

Remarks/Arguments begin on page **6** of this paper.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims

1-7. (Canceled)

8. (New) A non-transitory computer program product for automating the expert quantification of image data comprising:

a computer-readable medium encoded with computer readable instructions executable by one or more computer processors to quantify image sets comprising a locked evolving algorithm, wherein said locked evolving algorithm is generated by:

obtaining a product algorithm for analysis of a first set of image data wherein said product algorithm is configured to recognize at least one entity within said first set of image data via a training mode that utilizes iterative input to an evolving algorithm obtained from at least one first user, wherein said training mode comprises:

presenting a first set of said at least one entity to said user for feedback as to the accuracy of said first set of identified entities;

obtaining said feedback from said user;

executing said evolving algorithm using said feedback;

presenting a second set of said at least one entity to said user for feedback as to the accuracy of said second set of identified entities;

obtaining approval from said user about said second set of entities; storing said evolving algorithm as a product algorithm;

and

storing said product algorithm for subsequent usage on said image sets.

9. (New) The non-transitory computer program product of claim 8 wherein said evolving algorithm comprises a neural network.

10. (New) The non-transitory computer program product of claim 8 wherein said evolving algorithm comprises a classification engine.

11. (New) The non-transitory computer program product of claim 8 wherein said product algorithm comprises a pixel zoo.

12. (New) The non-transitory computer program product of claim 8 wherein said product algorithm comprises an entity zoo.

13. (New) A non-transitory computer program product for automating the expert quantification of image data comprising:

a computer-readable medium encoded with computer readable instructions executable by one or more computer processors to quantify image sets comprising a locked evolving algorithm, wherein said locked evolving algorithm is generated by:

obtaining mage data having a plurality of chromatic data points;

identifying which of said plurality of chromatic data points comprise an entity;

grouping said plurality of chromatic data points into a plurality of spatially connected subsets;

determining a plurality of characteristics about said spatially connected subsets;

passing said plurality of characteristics to a classification engine;

classifying said plurality of spatially connected subsets into at least one classification;

obtaining affirmation of the veracity of said at least one classification from a user;

evaluating said spatially connected subset to derive a set of relative harmonic amplitudes;

passing said relative harmonics into a neural network, wherein said neural network is trained to classify said spatially connected subsets using shape information provided by said set of relative harmonic amplitudes;

presenting a result of said classification to said user;

obtaining verification of said classification from said user;

using said verification to adjust said neural network; and

storing said neural network for subsequent usage on said image sets.

14. (New) The non-transitory computer program product of claim 13, wherein said plurality of characteristics comprises color and wherein at least one classification differ by color.

15. (New) The non-transitory computer program product of claim 13, wherein said plurality of characteristics comprises shape and wherein said at least one classification differ by shape.

16. (New) The non-transitory computer program product of claim 13, wherein said plurality of characteristics comprises texture and wherein said at least one classification differ by texture.

17. (New) The non-transitory computer program product of claim 13, wherein said plurality of characteristics comprises two or more sets of characteristics, wherein a first stage of processing classifies image data based on a first set of characteristics and a second stage of processing classifies image data based on a second set of characteristics.

18. (New) The non-transitory computer program product of claim 8, wherein said image data corresponds to histological section data.

19. (New) The non-transitory computer program product of claim 8, wherein said image data corresponds to material sample data.

20. (New) The non-transitory computer program product of claim 8, wherein said at least one entity corresponds to biological entities.

21. (New) The non-transitory computer program product of claim 8, wherein said at least one entity corresponds to amyloid plaques and neurofibrillary tangles.

REMARKS/ARGUMENTS

Claims 8-21 are pending in the present application. Claims 8 and 13 are independent. Claims 1-7 are canceled without prejudice or disclaimer of the subject matter claimed therein. No new matter is added. Support for these amendments may be found at least in the last pending claims of U.S. Patent Application Ser. No. 11/773,289, to which the present application claims priority. For at least the reasons stated herein, Applicant asserts that the claims as presented are patentable over the cited art and are therefore in condition for allowance.

Non-statutory Double Patenting Rejections

Claims 8-21 were found allowable in U.S. Patent Application Ser. No. 11/773,289 pending a Terminal Disclaimer for U.S. Patent No. 7,254,266. A Terminal Disclaimer for U.S. Patent No. 7,254,266 is filed herewith.

Conclusion

Applicant asserts that the claims as presented herein are patentable over the cited prior art for at least the reasons stated herein and are therefore in condition for allowance. Applicant respectfully requests a timely Notice of Allowance for the claims in this case.

Respectfully submitted,

COTMAN IP LAW GROUP, PLC

/EW64327/

Ellen Wei, Reg. No.: 64327
Tel. (626) 405-1413
Fax (626) 628-0404

EXHIBIT I

PTO/SB/26 (08-11)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	Docket Number (Optional) 1137-POO1004

In re Application of: Cotman, Carl et al.

Application No.: 13/267,879

Filed: 2011-10-06

For: METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

The owner*, Inventors Cotman, Chubb, Inagaki and Cummings, of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of **prior patent** No. 7,254,266 as the term of said **prior patent** is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

expires for failure to pay a maintenance fee;
is held unenforceable;
is found invalid by a court of competent jurisdiction;
is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
has all claims canceled by a reexamination certificate;
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Check either box 1 or 2 below, if appropriate.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 64327

/EW64327/ — Signature
4/23/2012 — Date

Ellen Wei
Typed or printed name

(626) 405-1413 Ext 29
Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) included.

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*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
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EXHIBIT I

Electronic Patent Application Fee Transmittal

Application Number:	13267879
Filing Date:	06-Oct-2011
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Filer:	Ellen Yi-Pen Wei
Attorney Docket Number:	1137-P001004

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

EXHIBIT I

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Statutory or terminal disclaimer	2814	1	80	80
		Total in USD ($)		**80**

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	12609789
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Ellen Yi-Pen Wei
Filer Authorized By:	
Attorney Docket Number:	1137-P001004
Receipt Date:	23-APR-2012
Filing Date:	06-OCT-2011
Time Stamp:	18:48:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$80
RAM confirmation Number	6343
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

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1		1137PA.PDF	78395 fc9eba8ec18d5d207d8d38cfae6fa68fb28cfdeb	yes	6

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Preliminary Amendment	1	1
Claims	2	5
Applicant Arguments/Remarks Made in an Amendment	6	6

Warnings:

Information:

2	Terminal Disclaimer Filed	1137TD.pdf	374309 3b1de485cf5314540470afb6ac208dc7db9f0845	no	2

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	29977 76b19f21dab6e04c345a37ed3c3fe0529270d4ed	no	2

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Total Files Size (in bytes):	482681

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PATENT APPLICATION FEE DETERMINATION RECORD
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Application or Docket Number	Filing Date	☐ To be Mailed
13/267,879	10/06/2011	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY ☒ FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 04/23/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0	X $30 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $125 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
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EXHIBIT I

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13267879
Filing Date	2011-10-06
First Named Inventor	COTMAN, Carl W.
Art Unit	2129
Examiner Name	
Attorney Docket Number	1134-P001004

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7254266		2007-08-07	Cotman et al.	
	2	7088854		2006-08-08	Cotman et al.	
	3	5479523		1995-12-26	Gaborski et al.	
	4	5555317		1996-09-10	Anderson, Peter G.	
	5	7783085		2010-08-24	Perlmutter et al.	
	6	7152051		2006-12-19	Commons et al.	
	7	6090044		2000-07-18	Bishop et al.	
	8	5919267		1999-07-06	Umes et al.	

EXHIBIT I

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13267879
Filing Date	2011-10-06
First Named Inventor	COTMAN, Carl W.
Art Unit	2129
Examiner Name	
Attorney Docket Number	1134-P001004

	9	5748847		1998-05-05	Lo, James Ting-Ho	
	10	6480627		2002-11-12	Mathias et al.	
	11	6628823		2003-09-30	Holm	
	12	6718054		2004-04-06	Lorigo et al.	
	13	6813373		2004-11-02	Suri et al.	
	14	6993185		2006-01-31	Guo et al.	
	15	5642434		1997-06-24	Nakao et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020186882		2002-12-12	Cotman, et al	
	2	20010009590		2001-01-29	Holm, Jack M.	

EXHIBIT I

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(**Not for submission under 37 CFR 1.99**)

Application Number	13267879
Filing Date	2011-10-06
First Named Inventor	COTMAN, Carl W.
Art Unit	2129
Examiner Name	
Attorney Docket Number	1134-P001004

	3	20080107330		2008-05-08	Cotman et al	

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If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EXHIBIT I

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13267879
Filing Date	2011-10-06
First Named Inventor	COTMAN, Carl W.
Art Unit	2129
Examiner Name	
Attorney Docket Number	1134-P001004

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/EW64327/	Date (YYYY-MM-DD)	2012-03-21
Name/Print	ELLEN WEI	Registration Number	64327

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

EXHIBIT I

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	12394087
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Ellen Yi-Pen Wei/Simon Fraser
Filer Authorized By:	Ellen Yi-Pen Wei
Attorney Docket Number:	1137-P001004
Receipt Date:	26-MAR-2012
Filing Date:	06-OCT-2011
Time Stamp:	16:36:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	IDS_Completed.pdf	612941 4f176b0a625605744b67c416d3b8b7ade35c05d8	no	5

Warnings:	
Information:	

EXHIBIT I

Total Files Size (in bytes):	612941

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/267,879

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	95		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	310		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	125		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	6 minus 20 =	*	x 30 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*	x 125 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	530		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/267,879	10/06/2011	2129	595	1137-P001004	6	2

CONFIRMATION NO. 3626

60984
Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

UPDATED FILING RECEIPT

OC000000052366721

Date Mailed: 02/07/2012

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Carl W. Cotman, Santa Ana, CA;
Charles F. Chubb, Irvine, CA;
Yoshiyuki Inagaki, Irvine, CA;
Brian Cummings, Irvine, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 11/773,289 07/03/2007
which is a CON of 11/474,064 06/23/2006 PAT 7254266
which is a DIV of 10/134,157 04/25/2002 PAT 7088854
which claims benefit of 60/286,897 04/25/2001

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

If Required, Foreign Filing License Granted: 10/20/2011

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/267,879**

Projected Publication Date: 05/17/2012

Non-Publication Request: No

Early Publication Request: No
** **SMALL ENTITY** **

EXHIBIT I

Title

METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

Preliminary Class

706

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where

the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

EXHIBIT I

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.: 13/267,879
Confirmation No.: 3626
Applicant: Carl W. Cotman et al.
Filed: 10/6/2011
TC/A.U.:
Examiner: ALAVI, Amir
Docket: 1137-P001004
Customer No.: 60984
For: METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

Commissioner for Patents
Mail Stop Missing Parts

RESPONSE TO NOTICE TO FILE MISSING PARTS OF APPLICATION

Dear Sir:

In response to the Notice to File Missing Parts of Nonprovisional Application mailed on October 25, 2011 Applicant, as a small entity, requests an extension of time of 1 month and submits herewith:

- Filing fee of $95;
- Search fee of $310;
- Examination fee of $125;
- Surcharge fee of $65; and
- Extension of time (1 month) fee of $75;

It is understood that this perfects the Application and no additional papers or filing fees are required. The total fee in the amount of $670 is being paid concurrently herewith on the Electronic Filing System (EFS) by way of the credit card payment. Please apply any other charges or credits to our Deposit Account No. 502689, referencing our Attorney Docket Number 1137-P001004.

Respectfully submitted,
COTMAN IP LAW GROUP, PLC

/EW64327/

Ellen Wei, Reg. No. 64327
Phone No. (626) 405-1413
Fax No. (626) 628-0404

EXHIBIT I

Electronic Patent Application Fee Transmittal

Application Number:	13267879
Filing Date:	06-Oct-2011
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Filer:	Ellen Yi-Pen Wei
Attorney Docket Number:	1137-P001004

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	95	95
Utility Search Fee	2111	1	310	310
Utility Examination Fee	2311	1	125	125
Pages:				
Claims:				
Miscellaneous-Filing:				
Late filing fee for oath or declaration	2051	1	65	65
Petition:				

EXHIBIT I

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with $0 paid	2251	1	75	75
Miscellaneous:				
		Total in USD ($)		**670**

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	11921834
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Ellen Yi-Pen Wei
Filer Authorized By:	
Attorney Docket Number:	1137-P001004
Receipt Date:	25-JAN-2012
Filing Date:	06-OCT-2011
Time Stamp:	18:30:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$670
RAM confirmation Number	6594
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

EXHIBIT I

1	Applicant Response to Pre-Exam Formalities Notice	58213.PDF	50796 7be12cc9111f17040846d35a733b8e6c5f33c776a	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38777 505a13d098d6e21e7e610fcc8f4b2d67562 1dc62	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	89573		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/267,879

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	95		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	310		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	125		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	6 minus 20 =	*	x 30 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*	x 125 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	530		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

EXHIBIT I

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/267,879	10/06/2011	2129	0.00	1137-P001004	6	2

CONFIRMATION NO. 3626

60984
Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

FILING RECEIPT

OC00000050498712

Date Mailed: 10/25/2011

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Carl W. Cotman, Santa Ana, CA;
Charles F. Chubb, Irvine, CA;
Yoshiyuki Inagaki, Irvine, CA;
Brian Cummings, Irvine, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 11/773,289 07/03/2007
which is a CON of 11/474,064 06/23/2006 PAT 7,254,266
which is a DIV of 10/134,157 04/25/2002 PAT 7,088,854
which claims benefit of 60/286,897 04/25/2001

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

If Required, Foreign Filing License Granted: 10/20/2011

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/267,879**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No
** **SMALL ENTITY** **

EXHIBIT I

Title

METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

Preliminary Class

706

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Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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EXHIBIT I

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EXHIBIT I

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/267,879	10/06/2011	Carl W. Cotman	1137-P001004

CONFIRMATION NO. 3626

60984
Cotman IP Law Group, PLC
117 E. Colorado Blvd.
Suite 460
Pasadena, CA 91105

FORMALITIES LETTER

OC000000050498713

Date Mailed: 10/25/2011

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  *Applicant must submit $**95** to complete the basic filing fee for a small entity.*

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- A surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of **$65** for a small entity in compliance with 37 CFR 1.27, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is $**595** for a small entity

- $**95** Statutory basic filing fee.
- $**65** Surcharge.
- The application search fee has not been paid. Applicant must submit **$310** to complete the search fee.
- The application examination fee has not been paid. Applicant must submit **$125** to complete the examination fee for a small entity in compliance with 37 CFR 1.27.

EXHIBIT I

Replies should be mailed to:

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If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/anguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

EXHIBIT I

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET

Substitute for Form PTO-1360
(For use with Form PTO/SB/06)

Application Number	Filing Date
13267879	

Applicant(s) Carl Cotman

* May be used for additional claims or amendments

CLAIMS	AS FILED		AFTER FIRST AMENDMENT		AFTER SECOND AMENDMENT	
	Indep	Depend	Indep	Depend	Indep	Depend
1	1					
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Total Indep	2		0		0	
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Total Claims	6		0		0	

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EXHIBIT I

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/267,879	Filing Date 10/06/2011	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☒		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 10/25/2011

	(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 5	Minus	** 20	= 0	X $30 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $125 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT

	(Column 1)		(Column 2)	(Column 3)					
	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/DAVID SASFAI/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

EXHIBIT I

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	Not yet assigned
Applicant:	Carl W. Cotman et al.
Filed:	Herewith
Docket:	1137-P001004
Customer No.:	60984
For:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

Commissioner for Patents
via EFSWeb

PRELIMINARY AMENDMENT

Dear Sir:

This Preliminary Amendment is hereby presented before first action. Please amend the application referenced above as follows:

Amendments to the Specification begin on page **2** of this paper.

Remarks/Arguments begin on page **3** of this paper.

EXHIBIT I

Attorney Docket No. 1137-P001004

AMENDMENTS TO SPECIFICATION

Please replace the first paragraph on Page 1 with the following amended paragraph:

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of United States Utility Patent Application Serial No. 11/773,289 filed 7/3/2007, which is a continuation of United States Utility Patent Application Serial No.11/474,064 filed 6/23/2006, which is a divisional of United States Utility Patent Application Serial No. 10/134,157, filed 4/25/2002, which claims benefit from United States Provisional Patent Application Serial No. 60/286,897, filed 4/25/2001, the specifications all of which are hereby incorporated herein by reference.

EXHIBIT I

Attorney Docket No. 1137-P001004

REMARKS

Please amend the application as indicated prior to examination. Applicants have amended the specification to include priority information. No new matter is added.

Applicant respectfully requests a timely Notice of Allowance for the claims in this case.

Respectfully submitted,

COTMAN IP LAW GROUP, PLC

/EW64327/

Ellen Wei, Reg. No.: 64327
Tel. (626) 405-1413
Fax (626) 628-0404

EXHIBIT I

UNITED STATES UTILITY PATENT APPLICATION

METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

INVENTOR:

Carl W. Cotman,
Charles F. Chubb,
Yoshiyuki Inagaki
Brian Cummings

CUSTOMER NUMBER 60984

COTMAN IP LAW GROUP, PLC
LOS ANGELES – 117 E. Colorado Blvd., Ste. 460 Pasadena, CA 91105

This application is a continuation of United States Utility Patent Application Serial No. 11/474,064 filed 6/23/2006 which is a divisional of United States Utility Patent Application Serial No. 10/134,157, filed 4/25/2002, entitled "METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS" which claims benefit from United States Provisional Patent Application Serial No. 60/286,897, filed 4/25/2001, entitled "METHOD AND APPARATUS FOR PERFORMING THE EXPERT QUANITIFICATION OF IMAGE DATA", the specifications all of which are both hereby incorporated herein by reference.

FIELD OF THE INVENTION

[001] This invention relates to the field of computer software or hardware. More specifically, the invention relates to a method and apparatus for generating special-purpose image analysis algorithms based on the expert classification of image data.

[002] Portions of the disclosure of this patent document contain material that is subject to copyright protection. The copyright owner has no objection to the facsimile reproduction by anyone of the patent document or the patent disclosure as it appears in the Patent and Trademark Office file or records, but otherwise reserves all copyrights whatsoever.

BACKGROUND

[003] The ability to differentiate between a series of one or more objects comes naturally to human beings. A 5-year old with a set of building blocks can separate the blocks according to size, color, texture, and many other discernible characteristics. Most children can even add more categories to the classification scheme as new qualities appear. For example, as the building blocks age, the surface of the building blocks may

fade. If new blocks are introduced to the child, the child can easily tell the difference between the new blocks and the old blocks. Current computer systems, however, find such tasks enormously difficult. Existing systems for classifying objects contained within an image are inherently limited and cannot, for example, effectively identify how many objects of a particular type exist in an image. The limitations of existing technologies become increasingly evident when complex images are to be processed. For example, when the characteristics that distinguish one entity from another are subtle and vary from entity to entity, existing computer systems become unable to accurately classify entities in an image as belonging to a certain type.

There are many uses for an improved system that can reliably quantify entities across multiple sets of image data. For instance, scientists, laboratory technicians, doctors, and other professionals have a need for a technology that enables the extraction of quantitative information from an image. Accurately counting the number of entities in an image requires that the person performing the count understand the various forms and nuances associated with the types of entity being counted. A pathologist may be able to look at a particular red blood cell sample and approximate how many red blood cells are in that sample. A research biologist may need to quantify the number of entities present in a histological brain section for purposes of an experiment, but be prevented from doing so by the lack of time or expertise required to manually perform such an analysis. Similarly, a materials scientist may want to count the number of carbon fibers within a

cross section of a structural support but be prevented from doing so due to the large number of carbon fibers in the structural support.

Current systems do not have a mechanism for incorporating the expertise of people skilled at identifying a certain entity type. As a result, there is a need for an image classification system that can incorporate such expertise and give others the opportunity to benefit from it. For instance, while a histologist may have the patience to count a few given entities, he or she will usually do so only to a limited degree due to time and cost. Thus the scientific field has been dominated by illustrating findings with a few select captured images resulting in overly qualitative conclusions. When image classification is utilized to support a particular finding, it is typically done so in areas where the fields are not particularly crowded or where the entities of interest in an image are rarely represented. Counting the number of entities in a crowded image has been impractical. Similarly the counting of entities requiring searching over many fields is impractical. There is another key issue however in terms of consistency of entity assignment among viewers, whether they be inexperienced or professional. Entities often have different features and diverse forms despite the fact they belong to the same entity class. In many cases even the professional has their own distinct classification criteria that are not clearly defined, giving rise to inconsistent results across studies. The labor, monotony, and expertise required for the task often precludes investigation into avenues that may have significant merit, but that are exceedingly difficult to perform.

Due to the problems associated with quantifying image data, there is a need for an improved technology that aids the process of obtaining quantitative data from images such as scientific samples. Such a technology has the potential to provide scientists and other users with important insights into the progression of many different diseases as well as the identification of distinguishing features among diseases. Likewise, chemists or materials scientists may discover new processes or improve compounds when aided in the classification and quantification of their unique images.

Some examples of current image quantification techniques and the problems associated with these techniques will now be discussed so as to provide the reader with an understanding of the need for an improved solution. Image Pro Plus, a software package for processing biological images, nicely exemplifies the standard approach to classification. Image Pro Plus™, is an example of a current system that provides a mechanism for counting, measuring, and/or classifying entities in digital images. Image Pro Plus provides the user with several methods for classifying pixels in terms of their colors. Image Pro Plus provides a mechanism for classifying entities in an image based on their morphology, but the system is difficult to use and does not "learn" how to improve its analytical skill over time. To classify the pixels in an image, the Image Pro Plus user must first interact with the application to define different pixel classes. For example, in the "color cube based dialog" Image Pro Plus divides the set of possible pixel colors into a cube, where a color corresponds to a point (r, g, b) in the cube with red, green and blue intensities r, g and b. The user defines as many distinct pixel classes as

he/she wishes. For each class, the user uses an eyedropper tool to select the colors he/she wants to include in the class. When all classes have been defined, Image Pro Plus displays an image in which pixels are partitioned into the appropriate pixel classes. If a given color has been included in two different classes, pixels of that color get assigned to whichever class was defined first.

What Image Pro Plus and other current systems lack is the ability to embody the knowledge of the trained histologist within a general tool that can be used to automate the classification of pixels and/or entities across a broad range of images. The importance of such a general tool lies in its potential to standardize the classification of histological structures across an entire biomedical field or subfield (e.g., the subfield focusing on Alzheimer's Disease). In addition, these same issues also hinder classification of image data in other scientific disciplines as well (e.g. materials science, chemistry, etc…).

Thus, there is a need for a system that improves upon the existing methodologies and systems for classifying image data. Such an improved system will now be described in detail.

SUMMARY OF THE INVENTION

An embodiment of the present invention comprises a method and apparatus for generating special-purpose image analysis algorithms based on the expert classification of image data. One embodiment of the invention provides a process and related apparatus for obtaining quantitative data about a 2-dimensional, 3-dimensional image, or other dimensional image. For example, the invention is capable of classifying and counting the various different types of entities an image contains. Each entity comprises an object, structure, or some other type of identifiable portion of the image having definable characteristics (e.g., texture, shape, color, etc…). The entities located within an image may have a different shape, color, texture, or other definable characteristic, but still belong to the same classification. In other instances, entities comprising a similar color, and texture may be classified as one type while entities comprising a different color, and texture may be classified as another type. An image may contain multiple entities, and each entity may belong to a different class. Thus, the system embodying the invention may quantify image data according to a set of changing criteria and derive one or more classifications for the entities in the image. Once the image data is classified, the total number of each class of entity in the image may be calculated and presented to the user. Put simply, the invention provides a way for a computer to determine what kinds of entities are in an image and optionally count the total number of each class of entities that can be visually identified in the image. In one embodiment of the invention, the system is trained to perform such analysis by a user skilled at the identification of a particular

object and/or entity. Once the system has been trained to master the classification process, the expertise gained during that training can be saved for subsequent usage by the same or a different user.

Some examples of the type of entity embodiments the invention may be configured to recognize include biological entities contained within histological sections, or physical entities in a material sample. Such biological entities may comprise any type of generalized cellular or non-cellular structure and the invention provides a mechanism for identifying and classifying different types of biological entities in a tissue section. For instance, the invention can evaluate stained tissue sections prepared by immunocytochemical and related techniques and determine what types of entities are contained in the tissue section and how many of those entities are present. Thus, a neuropathologist may utilize embodiments of the invention to classify and count the number of histological entities present in a digitized representation of a biological tissue section. However, the reader should note that the invention that will now be discussed herein is not limited to the realm of biological images alone. The system provides a mechanism for identifying any type of entity across any set of image data.

Obtaining quantitative data from histological sections in the study of dementias such as Alzheimer's Disease is crucial in understanding disease progression. However, due to the tedium of the manual counting task, systematic, large-scale counts are rarely obtained. If a tissue sample taken from a patient having Alzheimer's disease is evaluated, the system can identify tangles stained with reagents directed against tau as well as

plaques stained for Beta-Amyloid. Once these entities are identified, the system may count the number of tangles and plaques that are present in the image. Presently, the pathological diagnosis of Alzheimer's disease is based primarily on the presence or absence of plaques and tangles, but not on their absolute numbers because of the difficulties inherent in the quantification of these lesions and because of time constraints. A reproducible method of quantifying plaques and tangles across labs would allow more stringent classification standards. The problem of identifying cells in histological preparations has a long history in computer image processing. However, most researches have been focused on distinguishing cells from non-cells. Thus, there is a specific need in addition to the generalized need described above to have a program that can perform image processing in a way that can aid Alzheimer's research and/or any other scientific investigation that can utilize images.

DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram that illustrates the classification of a plurality of different entities with an image.

Figure 2 illustrates a high-level view of the process used to evaluate image data to generate an algorithm based on feedback from a user that is capable of deriving quantitative information about entities within the image.

Figure 3 illustrates a high-level view of the additional process step utilized during evaluation of image data in accordance with one embodiment of the invention.

Figure 4 illustrates a high-level view of the additional process step utilized during evaluation of image data in accordance with one embodiment of the invention.

Figure 5 illustrates a high-level view of the methodology for processing image data using a neural network engine in accordance with one embodiment of the invention.

Figure 6 illustrates the process of selecting and initiating a user mode in accordance with one embodiment of the invention.

Figure 7 comprises a block diagram illustrating the various user modes in accordance with an embodiment of the invention.

Figure 8 illustrates the processing steps performed when the system is in automated user mode in accordance with one embodiment of the invention.

Figure 9 illustrates the processes associated with the independent user mode in accordance with one embodiment of the invention.

Figure 10 illustrates a general hardware environment that may be utilized to implement an embodiment of the invention.

Figure 11 illustrates the components incorporated within the system in accordance with one embodiment of the invention.

Figure 12 illustrates an original image to be processed in accordance with one embodiment of the invention.

Figure 13 illustrates a reconstructed outline of the original image in accordance with one embodiment of the invention.

Figure 14 illustrates a reconstructed outline of the original image in accordance with one embodiment of the invention.

Figure 15 illustrates a reconstructed outline of the original image in accordance with one embodiment of the invention.

Figure 16 illustrates a threshold image of a single entity example in accordance with one embodiment of the invention.

Figure 17 illustrates the relative Fourier descriptors of the example single entity (e.g., plaques).

Figure 18 illustrates a threshold image a double entity (e.g., biological entity such as plaques) in accordance with one embodiment of the invention.

Figure 19 illustrates the relative Fourier descriptors of the example double entity in accordance with one embodiment of the invention.

Figure 20 illustrates a threshold image a triple entity (e.g., biological entity such as plaques) in accordance with one embodiment of the invention.

Figure 21 illustrates the relative Fourier descriptors of the example triple entity in accordance with one embodiment of the invention.

DETAILED DESCRIPTION

A method and apparatus for generating special-purpose image analysis algorithms based on the expert quantification of image data is described. In the following description numerous specific details are set forth in order to provide a more thorough understanding of the present invention. It will be apparent, however, to one skilled in the art, that embodiments of the present invention may be practiced without these specific details. In other instances, well-known features have not been described in detail so as not to obscure the invention.

The invention may be implemented in a hardware device and/or software form and may, for example, comprise computer readable program code tangibly embodied in a computer readable medium such as a processor, or memory coupled to the processor. In other instances, the invention executes in memory such as a hard disk, floppy disk, and/or or any other form of memory capable of storing computer readable program code. An embodiment of the invention contemplates the use of multiple computers to process image data and the invention may store or capture data image data in multiple locations accessible via a network.

System Overview:

One embodiment of the invention provides a process and related apparatus for obtaining quantitative data about a 2-dimensional, 3-dimensional image, or other

dimensional image. For example, the invention can be used to produce a product algorithm capable of classifying and counting the numbers of different types of entities an image contains in accordance with the judgment of the user. Each entity may comprise an object, structure, or some other type of identifiable portion of the image having definable characteristics (e.g., a texture, shape, size, color, density, etc…). The entities located within an image may have a different shape, color, texture, or other definable characteristic, but still belong to the same classification. In other instances, entities comprising a similar color, and texture may be classified as one type while entities comprising a different color, and texture may be classified as another type. An image may contain multiple entities, and each entity may belong to a different class. The system embodying the invention may be used to produce many different product algorithms, which may be used to classify image data according to different criteria,. Once the image data is classified using a particular product algorithm generated using an embodiment of the invention, the total number of entities in the image may be calculated and presented to the user. Put simply, the invention provides a way for a user to generate a product algorithm that can be used to determine what kinds of entities are in an image and count the total number of entities that can be visually identified in the image.

In one embodiment of the invention the system utilizes of a set of evolving algorithms (e.g., Bayes' Theorem, a neural network, or any other image classification algorithm) to evaluate image data. The system may utilize any one of the evolving algorithms to evaluate different features of the image and may execute multiple iterations

of each algorithm. For instance, the user interacts with the system to generate a product algorithm comprising two processing stages. A first stage of processing, for example, may classify image data based on color and/or texture, and a second stage of processing may then evaluate parts of the image based on shape. The use of the invention to evolve a product algorithm may require one or more iterations in which the system uses input from the user to refine its model of (i) the different classes of material composing entities in the image, and (ii) the different classes of entities occurring in the image. User input during the evaluation can modify the evolving product algorithm. For example, user input may be used by the system to change the parameters defining a certain class of entities thereby enabling the mechanism to evolve. Once an acceptable scheme has evolved (e.g., the probabilities and/or neural network analysis consistently classifies different entities correctly), the evolving algorithm may be locked in place to yield a first product algorithm. Then a daughter algorithm allowed to further evolve. Once an evolving algorithm is locked in place it may be referred to as a product algorithm that can be stored for subsequent usage by the same or a different user and applied to additional image sets for purposes of analysis.

Some examples of the type of entities product algorithms configured in accordance with embodiments of the invention may be trained to recognize include biological entities contained within histological sections. Such biological entities may include any type of generalized cellular or non-cellular structure, and the invention provides a mechanism for producing product algorithms capable of identifying and

classifying different types of biological entities in a tissue section according to various different criteria. For instance, the invention can be used to generate one or more product algorithms to evaluate stained tissue sections prepared by immunocytochemical and related techniques and determine what types of entities are contained in the tissue section and how many of those entities are present. Thus, a neuropathologist may utilize embodiments of the invention to generate product algorithms to classify and count the number of histological entities present in any digitized representation of a biological tissue section. For instance, if a tissue sample taken from a patient having Alzheimer's disease is evaluated, the system can be used to generate a product algorithm to identify tangles stained with reagents against tau as well as plaques stained for Beta-Amyloid. Once these entities are identified, the system may count the number of tangles and plaques that are present in the image.

It is important to note that the illustrations provided here are for exemplary purposes and the process utilized to quantify image data also has applications in arenas other than the identification of biological entities. The invention is not limited solely to the quantification of histological samples and is intended to have applications for analyzing other types of images. Thus, users may also utilize the process described herein to generate product algorithms to evaluate any type of digitized image and classify any of the entities in that image that have definable characteristics. These characteristics may change over time as the system and the user learns more about the structures being analyzed.

Example Image Classification:

Figure 1 is a block diagram that illustrates the classification of a plurality of different entities with an image. Referring now to Figure 1 for example, a representation of an image 100 comprising a group of entities 101-107 is shown. Embodiments of the invention provide a mechanism for producing a product algorithm to classify and identify the entities contained within the image. The mechanism embodying aspects of the invention may take the form of computer software, and the process or methodology captured for performing such classification can be utilized by multiple instances of such computer software. Each entity 101-107 represents a portion of a digitized image that has one or more definable characteristics. Entity 101 may represent a cellular or non-cellular entity, a tangible object, a person, thing, or a representation of a tangible object (e.g., a radar image of a particular airplane), person, or thing. Entity 101, has at least one characteristic and may, for example, be associated with the characteristics A, B, and C. Entity 102 may be associated with the characteristics D, E, and F. Entity 103 may be associated with the characteristics G, H, and I. Entity 104 may have a set of characteristics similar to entity 103. Entities 105 and 107 are associated with characteristics similar to those associated with entity 102. Entity 106 is associated with characteristics J, K, and L. In one embodiment of the invention, structures that have similar characteristics are placed into the same class. Thus, entities 103 and 104 may belong to class 1 and entities 102, 107, and 105, for example, may be assigned to class 2. Since entities 101 and 106 each have different characteristics, they are each assigned to

their own class. Once the entities in an image are classified, the process utilized to make such a determination may be stored in the form of a product algorithm (e.g., an instance of the evolving algorithm) and the system may use that algorithm to count the number of entities in each class.

Overlapping entities (e.g., 103 and 104) are counted in accordance with one embodiment of the invention as separate structures. Class 1, for example, has a count 120 of two entities and class 2 has a count 121 of three entities. The remaining classes each have one entity. Thus, class 3 has a count 122 of one entity and class 4 has a count 123 of one entity. Once the entities are classified by an embodiment of the invention, a total count of the number of each type of entity can be performed. The process for making such entity classifications will now be discussed in more detail.

<u>High-Level Process Flow:</u>

Figure 2 illustrates a high-level view of the process used to evaluate image data to generate an algorithm based on feedback from a user that is capable of deriving quantitative information about entities within the image. The process initiates when the system embodying the invention obtains an image having a number of chromatic data points (e.g., step 200). For instance, the system may capture a picture using a mechanism such as a digital camera, video camera, or scanning device. The invention contemplates the use of many different types of image acquisition devices and can be adapted to interface with any device capable of obtaining a digital image or representation of an

image. Most conventional video capture cards that provide a resolution of 640 x 480 or greater provide a sufficient basis for analysis. However, the system may be adapted to utilize image data of any resolution. True-color (24-bit) is used in one embodiment of the invention, since this provides a significant range of colors to evaluate. The invention is not limited, however, to the use of true-color and can process many different types of image data (e.g., black and white, grayscale, or color of arbitrary spectral dimension and of any bit depth).

Once the image acquisition device captures the image data, the captured image data is provided to the system where it is stored in memory or otherwise held for subsequent processing. Any computer readable medium capable of storing digital or analog data may be adapted to hold the captured image data. In one embodiment of the invention each chromatic data point represents a pixel or some other subset of the image data having an associated color value (e.g., RGB, CMYK, PMS, Pantone™, or any other definable color space). Each pixel may be a single dot or a series of interconnected dots (e.g., NTSC, PAL, etc..). The image may have millions of different chromatic data points. However, one or more of the chromatic data points may have an identical or similar range of values. For instance, the image may have two pixels that contain the same or similar RGB values. Each image contains one or more entities comprised of a plurality of chromatic data points. The entities are visual representations of structures, objects, or other portions of the image having definable characteristic that may be identified via the process of image quantification described herein.

Once the image is acquired the system begins to evaluate the image data to determine what portions of the image can be classified as certain entities. The initial evaluation may or may not involve user input (e.g., step 201). However, if user input is provided the system utilizes such input to aid the process of entity identification. In one embodiment of the invention, the system provides an initial guess as to which of the plurality of chromatic data points comprise an entity (e.g., step 202). There are multiple mechanisms by which the identification process of step 202 may occur. For example, the system may analyze the image to determine the number of pixels that fall within a color range (e.g., tolerance level). The tolerance or threshold that is utilized can be determined by the user or by the system. Embodiments of the invention allow the user to select an area of the image that contains an entity to be counted or classified. The selected area can be referred to as a sample set of chromatic data points. The user may, for example, select a single chromatic data point or a set of chromatic data points that comprises the entity or set of entities targeted for classification. The system then analyzes the sample set of chromatic data points identified by the user and uses the results of the analysis as a basis for identifying which parts of the image may contain an entity.

In other instances the user may identify which portions of the image are background. The system then uses that identification to approximate which chromatic data points are background and which may be entities. The system may also be configured to guess which parts of the image are background and which parts of the

image are not by using data gathered during analysis of other images identified as containing similar entities.

If the system was previously utilized to evaluate similar images, the system may be configured to utilize the information gathered during the previous analysis and utilize that information for initially approximating which portions of the image contain entities. In accordance with one embodiment of the invention identifying which of said plurality of chromatic data points comprises an entity (e.g., step 202) may also entail obtaining a probability that some or all of the chromatic data points that make up the image belong to one or more pixel classes (see e.g., Figure 3 step 300). For instance, the system may determine which parts of the image falls within a certain range or distribution of color values collectively referred to as a pixel class. Each image contains multiple pixel classes and the pixel classes may contain overlapping values. A first pixel class defined as comprising the color values 0,0,0 through 155, 23, 34 may overlap with a second pixel class when the second pixel class contains values that fall within the range defined by the first pixel class. The user may define the composition of the pixel class by selecting one or more chromatic data points from the image. Alternatively, in one embodiment of the invention, pixel classes are defined by density functions that assign non-zero values to all chromaticities. Thus, each pixel class may include all possible chromaticities. However, a given pixel-measure vector may have higher probabilities in some pixel classes than in others.

The probability may be based in whole or in part on the identification made by the user and/or a previous analysis of an image identified as a certain type (e.g., a tissue section likely to contain cancer cells stained in a certain manner). Such probabilities may be referred to as prior probabilities, but can also contain additional measures for evaluating the image. Once various portions of the image are associated with one or more pixel classes (e.g., based on the RGB value of the sampled chromatic data point), the chromatic data points may be assigned to a certain pixel class based on the probability the data point belongs to that class (e.g., step 302). This initial approximation may be performed with or without user input. However, in one embodiment of the invention a user provides the system with information that can be used to help derive prior probabilities. The user may, for example, provide information based on the user's own experience that aids the system in determining the probability a pixel will belong to a certain class. As mentioned above, user input is not required and the system may assume at the outset that all classes (including background) are equally probable. Then after a few images have been classified (and ratified by the user e.g., at step 204), the system is able to obtain an understanding about a cross-section of the image population that may be used to estimate prior probabilities more accurately. The understanding is incorporated into the analysis performed by the system using the evolving algorithm and can be saved for later usage as a product algorithm. The system's ability to classify entities improves over time as the number of classified images held in an entity zoo increases (see e.g., Figure 9; elements 920-936). The entity zoo is discussed in further detail below.

Embodiments of the invention may be configured to perform varying iterations of analysis (e.g., using the same or various other methodologies or algorithms for evaluating the image data). The various types of analysis may be performed at the entity identification phase of the process and each iteration of analysis is designed to further refine the evolving algorithm's ability to classify image data.

In one embodiment of the invention, the system initiates an iteration of analysis where it groups the chromatic data points into maximal spatially connected subsets whose points are in the same pixel class (see e.g., Figure 4 step 400). In one embodiment of the invention, such maximal spatially connected subsets of chromatic data points may also be referred to as blobs, and the grouping of chromatic data points into blobs is referred to as blob partitioning. In this embodiment of the invention, entities are required to be blobs of different types. However, the invention contemplates relaxing these restrictions in several ways. First, blobs may be allowed to comprise not only maximal spatially connected subsets of pixels from the same class, but maximal subsets of pixels from the same pixel class such that every pixel in the blob is within a specified distance of some other pixel in the blob. Second, the invention contemplates allowing entities to consist of collections of several blobs from one or more pixel classes (rather than requiring every entity to consist of a single blob). The grouping of chromatic data points may involve obtaining a probability that the spatially connected subset is associated with a particular entity, and groupings may then be utilized to aid the system in assigning each of the chromatic data points to an entity.

In the use of the invention to evolve a product algorithm, the results of the initial approximation or a subsequent approximation can be presented to the user for verification (See e.g., step 204 of Figure 2) via any type of user interface. In one embodiment of the invention a verification message is displayed to the user for purpose of obtaining input from the user that reflects the user's judgment about the accuracy of a classification. The verification message is transmitted to the user via any viable data path and may be sent to users in remote locations via an interconnection fabric such as a computer network. Upon receipt of the verification message, the user makes a judgment about the correctness of the classification. For instance, the user may acknowledge the correctness of the identification or indicate that a portion of the image the system identified as a certain type of entity is an entity of a different type. The data collected from the user during this process is stored and utilized in accordance with one embodiment of the invention for subsequent analysis of the image. Over time the system learns from obtaining feedback from the user and thus the ability of the system to properly identify, classify, and count the number of entities in the image improves.

For instance, at step 204, the system may present the initial identification to the user for feedback as to the classifications made and use that feedback as input to another iteration of the entity identification step 202 illustrated in Figure 2. The system may execute multiple iterations of this loop until the user indicates a desire to lock the evolving algorithm used to identify the entities in place and thereby commit an instance of the algorithm to memory (see e.g., step 205). When an evolving algorithm is locked

that algorithm can now be referred to as a product algorithm (or an instance of an evolving algorithm) and can be applied to different images or set of images by different users than the user responsible for training the algorithm (see e.g., step 206). However, the reader should note that the product algorithm essentially a saved instance of the evolving algorithm and that like the evolving algorithm it may also be permitted to evolve. In some instances, such evolution may not be desirable. This is particularly the case when an expert at a particular type of image classification was involved in training the product algorithm and the ultimate user of the product algorithm is a novice at identifying such classifications.

The system may store any of the data collected during the image analysis and use that data to aid subsequent analysis. Image data, user data, verification data, probability data, and any other information collected during evaluation of the image can be stored in a data repository and later utilized. Previous results obtained from the data repository can be used to determine probabilities. Such stored data is referred to in one embodiment as the product algorithm, although generally speaking the evolving algorithm may also utilize the stored data in any manner deemed helpful to the image analysis. Both the evolving algorithm and the product algorithm are capable of using the learned ability to classify a particular type of entity to generate a result that comprises an approximation of the total number of entities in the image (e.g., step 207).

Neural Network Overview:

Embodiments of the invention may be configured to additionally process the acquired image data using a neural network engine. Figure 5 illustrates a high-level view of the methodology for processing image data using a neural network engine in accordance with one embodiment of the invention. The neural network engine comprises a neural network and may optionally contain preprocessing functionality capable of preparing data for processing by the neural network engine. The preprocessing functionality may be contained within the neural network engine or part of another module that interfaces with the neural network engine.

For example, the system may obtain an image having many different chromatic data points (e.g., step 500), identify which of the chromatic data points comprise an entity (e.g., step 502 which may occurs via user input or automatically by the system via a classification algorithm), group the chromatic data points into one or more spatially connected subsets (e.g., step 504 which may group portions of the image together that fall with a certain color distribution), and determine a plurality of characteristics about each of the spatially connected subsets (e.g., step 506). These characteristics may then be passed to a classification engine for processing (e.g., step 508). The classification engine utilizes the characteristics of the spatially connected subsets to classify each of the spatially connected subsets into a classification (e.g., step 510). Some spatially connected subsets are assigned to a first class identifying the entity as a certain type and other spatially connected subsets may be assigned to a second class. In one embodiment

of the invention the classification engine utilizes Bayes' Theorem as the basis for determining the appropriate classifications. Subsequent (or previous) evaluations of the image data may occur using Fourier Shape Descriptors and/or a neural network. The determination made by the classification engine is then presented to the user for affirmation as to the veracity of the classification (e.g., step 512). Feedback (513) obtained from the user at this point can be used as input to one or more subsequent iterations of the classification engine. Optionally, the system may elect to pass a subset of the classification data to a neural network classifier engine (e.g., step 514).

The neural network classifier comprises a system of program and data structures designed to approximate the operation of the human brain. The neural network classifier may contain a large number of processors operating in parallel where each processor has a sphere of knowledge it understands. The classification data and/or other input are utilized to train the neural network and thereby increase the network's sphere of knowledge. The subset of data passed to the neural network in one embodiment of the invention is derived according to criteria defined by a user or users. The spatially connected subset is then evaluated to derive a set of relative harmonic amplitudes (e.g., step 516). The relative harmonic amplitudes may also be performed independently of the neural network engine. A fast Fourier transform calculation may be used to derive each relative harmonic amplitude. When a spatially connected subset is passed to a neural network classifier engine, the perimeter of the spatially connected subset is traversed counterclockwise and an *N*-point boundary of it is extracted. Then, a discrete Fourier

transform algorithm is applied to the *N*-point boundary to calculate pairs of harmonic amplitudes, $|z_n|$ and $|z_n|$ for n = 1, 2, …,*N*. typically focuses only on $|z_n|$ and $|z_n|$ for n = 1, 2, …, 10. Each of these 20 harmonic amplitudes is divided by the largest amplitude of these 20 amplitudes to yield a relative harmonic amplitude.

$$|z_n'| = \frac{|z_n|}{M}, \text{ where } M = \max\{|z_k| \mid k = \pm 1, \pm 2, \ldots, \pm 10\}.$$

Specifically, in one embodiment of the invention, the relative amplitudes of the low-order 20 Fourier shape descriptors of the boundary of the spatially connected subset are computed. These 20 values may be referred to as harmonic amplitudes. These 20 harmonic amplitudes are submitted as input to the neural network, which uses them to classify the connected subset as a specific type of entity. The reader should note, however, that more or less than 20 harmonic amplitudes may be utilized and that the ultimate number utilized depends upon the size and complexity of the image begin analyzed. Some embodiments of the invention may utilize other shape descriptors to define boundaries. Thus, the invention is not limited to the use of low-order Fourier shape descriptors, but can use any shape descriptor capable of defining boundaries.

Submit relative harmonic amplitudes to the neural network (e.g., at step 518). More specifically, for example, each blob (e.g., spatially connected subset) generates a corresponding vector of 20 relative harmonic amplitudes. These 20 relative harmonic amplitudes can be provided to the neural network as input at step 518. The neural

network, configured in accordance with one embodiment of the invention is trained to classify the spatially connected subsets using shape information provided by the set of relative harmonic amplitudes (e.g., step 520). The results of the classification performed by the neural network can then be optionally presented to the user for verification (e.g., step 522). The neural network may then utilize the user feedback (524) to adjust its analysis in accordance with the input obtained from the user. Thus, the input can be utilized as training criteria and used to improve performance of the image analysis over time. Once the entity classification engine and/or the neural network engine are deemed by the user to be appropriately trained, the user may elect to lock the algorithms generated by classifying a particular type of entity into place for subsequent use on the same or another set of images (see e.g., step 523).

The neural network in one embodiment of the invention comprises one input layer, two hidden layers and one output layer. The input layer may comprise, for example, 20 input neurons and one bias input neuron (although there may be more or less input neuron or bias input neurons). Each hidden layer comprises 16 hidden neurons, and the output layer comprises 5 output neurons (although there may be more or less hidden neurons or output neurons). This is a fully connected feed-forward network with three layers of adaptive weights. Networks having three layers of weights can generate arbitrary decision regions, which may be non-convex and disjoint.

The neural network accepts a number of relative harmonic amplitudes associated with a spatially connected subset (e.g., 20 although the number may differ depending upon the size of the image). Each output neuron corresponds to a specific class of entity. The outputs of all output neurons are compared, and then, the index of the output neuron that gives the largest value is returned as the class of the spatially connected subset whose relative harmonic amplitudes were presented to the input layer.

Although the neural network is pre-trained, the user can train the network through back-propagation as the user indicates a correct classification to the network. The user also can save the trained network for later use.

System Components:

Figure 11 illustrates the components incorporated within the system and input provided to the system in accordance with one embodiment of the invention. User input 1106 may be provided to a classification engine 1108, neural network engine 1112 or to other engines or modules 1114 configured to enhance or add functionality to the system. Classification engine 1108 may be involve manual input from the user (e.g., a sample set) or automatically obtain input from the image. In one embodiment of the invention, Classification engine 1108 classifies based on color or some other measure such as texture and provides such data to image processing application 1102 which utilizes at least one of the image processing methodologies described herein to generate classified image 1110. For instance, the image processing application may utilize multiple

iterations of Bayesian processing and/or may also use multiple iterations of processing performed by the neural network engine 1112. Such processing enables image-processing application 1102 to continually evolve and improve over time as the number of images (or amount of information) it reviews increases. After performing the methodology described herein, neural network engine 1112 may perform some level of classification (e.g., 1118) on identified spatially connected subsets and can therefore output the number of entities (e.g., objects) in spatially connected subsets (e.g., blobs) (e.g., 1116). This data may be utilized by the image processing application in some instances. Attributes (e.g., color, texture, radius, size, proximity to other entities, or any other useful descriptive feature, etc...) of classified image data 1110 are typically stored in image evaluation database 1120. The information stored in the image evaluation database 1120 can be referred to as the product algorithm. The attributes or stored values are loaded into a database 1104 (e.g., a neuropathology database) and the information may be utilized to derive prior probabilities 1105 that can be used by the image processing application for subsequent analysis of the same or different images. Such aggregate image data can be made available to other scientists to verify patient diagnosis, aid in the selection of samples for further research purposes etc... In addition entities may be compared with other non-visual data (e.g., genetic information, demographics, sex, disease presence, disease subtype, severity of the disease, subtypes of individuals including race, disease severity, prior medical history, genetic profiles). Entities can also be compared to data sets derived from similar sources containing genetic profiles of individuals (e.g., gene fingerprints). For example, the fine features of neuropathology can

be effected by gene mutations, age itself, sex, etc… and thus could constitute a distinct feature of an evolving algorithm.

The image data itself is typically held in raw image database 1100, although image data or any of the other information stored by the system may be held in any type of memory medium that allows such data to be retrieved. Image data 1100 is what is initially provided to the user and/or system for evaluation.

Specific Modes of Operation:

Now that a brief overview of the processes and components utilized by an embodiment of the invention has been described, a more detailed discussion of the modes of operation will follow. Figure 6 illustrates the process of selecting and initiating a user mode in accordance with one embodiment of the invention. When a computer program or system incorporating aspects of the invention initiates, the user may select a user mode (600). If the user selects automated user mode 602, the system loads predefined pixel zoo database 604 and predefined entity zoo database 606 from data storage 612 (the data in the pixel zoo and entity zoo determines a product algorithm). The user then selects a set of images to process (608) and initiates processing (610) of the image data. The specific details associated with that processing and the contents of the databases referred to above are described in more detail in Figure 8. Subsequent to processing the image data may be stored in data storage 612.

If the user selects the independent user mode 614, the system captures a new image or loads an image set 616. The pixel zoo and entity zoo determining a product algorithm are then defined (e.g., 618) using a recursive series of processing techniques described in further detail in Figure 9. Once the user is satisfied with the result, the product algorithm can be stored at step 620, the data defining the pixel zoo and entity zoo can be stored in data storage 612, but may also be stored in other locations where the data contained therein can be retrieved for subsequent usage during image processing of the same or different image. Data storage 612 may also contain the image data itself, but like the zoo data, image data may be stored in any location where it can be retrieved.

Figure 7 comprises a block diagram illustrating the various user modes in accordance with an embodiment of the invention. For example, the system 720 may operate in an automated user mode 700 and an independent user mode 702. The system may operate in one or more of these modes. In automated user mode 700, the system operates automatically to classify the input image with no user intervention required (however, the user may provide input if such input is desirable). When the system is in automated user mode 700 the system takes as primary input one or more images and produces a set of classified images. In one embodiment of the invention, the data stored in the pixel zoo and entity zoo is utilized in automated user mode 700 as a classification aid.

In independent user mode 702 the system is trained to perform classifications in accordance with feedback provided by an independent user. The purpose of operation in

independent user mode is to produce tools (e.g., a product or evolving algorithm) that can be used to classify new images supplied to the system in automatic mode. If biological tissue samples are to be analyzed, the independent user may represent a trained histologist or some other user with an expertise in the nuances of evaluating biological tissues. The reader should note that although images of biological tissue samples are used as examples herein, the invention is not limited to analysis of such images. The system embodying the invention may be adapted to evaluate any type of image to classify an object and/or other entity contained in the image. When in independent user mode 702 one embodiment of the invention obtains image data from a repository of images. The output produced in independent user mode may comprise (1) a pixel zoo (e.g., samples of pixel-measure vectors representative of the various different pixel classes in the image); (2) a set of pixel class definitions, where each definition comprises a vector of parameters enabling the system to compute for new pixel chromaticities (e.g., chromatic data points), the probabilities that each pixel belongs to a different pixel classes; (3) an entity zoo (e.g., a collection of images of various different types of possible entities or objects), and (4) a set of entity definitions where each entity definition represents a vector of parameters enabling the system to compute for new entities the probabilities the entity belongs to the various different entity classes. The output generated in independent user mode can be stored and utilized for subsequent processing of other images.

The system's efficacy in automated user mode 700 depends in large part on the expertise the system acquires when operated in independent user mode 702. However, the description of independent user mode is easier to understand once the reader is clear how automated user mode 700 operates. Accordingly, automated user mode 700 is described in detail first. In addition there may be an interactive training mode 704 which can be used to train users how to identify entities. For instance, novice users may utilize the system to learn how to mimic the identification abilities of an expert. Thus the system may present entities previously classified by an expert so that the novice user may gain an understanding of what type of entities fall within which type of classification.

Automated User Mode Operation:

A. Image Acquisition:

As was mentioned above, the first step for performing processing on image data is to capture or load the image data (see e.g., Figure 8, block 800). For instance, if biological tissue data is to be processed, the system will obtain a digitized image *I* of a tissue sample. The input image *I* may be loaded from a database or captured directly from a slide using a microscope and CCD camera. To each pixel location (x,y) in the image field, the input image *I* assigns an *m*-tuple $I[x,y] = (\lambda_1[x,y], \lambda_2[x,y],\ldots, \lambda_m[x,y])$ of light spectral measurements. For human vision, three measurements are typically sufficient to completely represent any color. For this reason, standard CCD cameras and scanning equipment are designed to collect three light spectral measurements per pixel.

However, it should be noted that a machine vision application of the sort described herein might well take useful advantage of a potentially richer, higher than 3-dimensional chromatic image representation.

B. Pixel classification:

The system embodying the invention proceeds to assign each pixel in the Input Image *I* to one of several possible *pixel classes* (see e.g., Figure 8, block 804) which reflect the different general types of material to which that pixel might belong. For example, in a single labeled biological section, two classes are likely to be present: positively labeled entities (densely stained) and the background (weakly stained, or unstained). In double-labeled biological tissue sections, three classes are likely to be present: the primary entities – labeled with one stain, and the secondary entities – labeled with the other stain, and the background. The system can use arbitrary numbers of pixel classes, depending on the chromagens used, and the ways in which different types of biological material interact with them. In the general case, each pixel will be assigned to one of the pixel classes $c_0, c_1, \ldots, c_n$, where c_0 conventionally denotes the "background" class, and each of the classes c_i, $i = 1, 2, \ldots, n$, corresponds to a particular type of spectrally and/or texturally distinct histological material of interest.

A Bayesian classifier is used in one embodiment of the invention to assign pixels to different classes. The user may select a *pixel zoo* database 806 previously produced 808 by using the system in Independent User Mode. The data held in *pixel zoo* database

806 is also referred to in accordance with one or more embodiments of the invention as a product algorithm. This pixel zoo comprises representative samples S_i of *pixel-measure* vectors $v = (v_1, v_2, \ldots, v_r)$ from each pixel class, c_i, $i = 0, 1, \ldots, n$. The coordinate values in the pixel-measure vector $v[x, y] = (v_1[x,y], v_2[x,y], \ldots, v_r[x,y])$ corresponding to a particular pixel (x, y) typically include the light spectral values, $\lambda_1[x,y], \lambda_2[x,y], \ldots, \lambda_m[x,y]$, assigned to pixel (x,y) in the input image, but may also include additional (context-sensitive) statistics reflecting aspects of the configuration of light spectral values assigned to other pixels in the neighborhood of (x, y). Such additional statistics can provide the pixel classification process with sensitivity to textural properties of image material. Typically, the pixel zoo supplied by the user will have been extracted from one or more images whose preparation history is identical or similar to that of the current image(s). Also stored in the pixel zoo are the following parameters, derived from the samples S_i:

I. *Estimated pixel class prior probabilities.* For each pixel class c_i, the prior probability $p[c_i]$ is the proportion of pixels in the current image that the system expects (based on previous experience) to belong to class c_i.

II. *Estimated pixel class definitions.* Associated with each pixel class c_i is a conditional probability density $f(v|c_i)$. For any possible pixel-measure vector v,

and any pixel class c_i, $f(v|c_i)$ gives the probability density that a pixel in class c_i will have pixel-measure vector v. That is, for any pixel (x,y), $f(v|c_i)$ is the probability density that $I[x,y] = v$, given that pixel (x,y) is in class c_i. The *definition of pixel class* c_i is a parametric approximation of $f(v|c_i)$ derived from the sample S_i (e.g., using a modified Expectation Minimization (EM) algorithm). The EM algorithm is modified in one embodiment of the invention so that it updates its parameters after each observation of one new data point. The algorithm generates a mixture of Gaussian probability density functions. Each Gaussian function, called an "expert" in one embodiment of the invention, accounts for a subset of data points. After each observation of a new data point, the algorithm can add, if necessary, an expert to a mixture of experts, which generates the probability density function covering the set of data points given thus far. It also can delete an expert when the expert is found unnecessary after each observation. After all the data points are observed, the algorithm updates the parameters in a batch mode in order to merge down experts, whose fields have a large overlap. As a result, the number of necessary experts is automatically determined and satisfactorily optimized. The term expert should not be confused with expert user that specifically involves human input.

Given (i) the *a priori* probability $p[c_i]$ that any given pixel (x,y) belongs to class c_i, and (ii) the conditional probability density $f(v|c_i)$ that a pixel in class c_i is

assigned pixel-measure vector *v*. Bayes' Theorem is now used to compute the posterior probability (See e.g., Figure 8, Box 802),

$$P_i[x,y] = p_{posterior}[c_i \mid v[x,y]] = \frac{p[c_i]f(v[x,y] \mid c_i)}{\sum_{k=1}^{n} p[c_k]f(v[x,y] \mid c_k)}. \qquad (1)$$

$P_i[x,y]$ gives the probability, based on prior knowledge and current information, that pixel (x,y) is contained in class c_i.

Each pixel (x,y) is now assigned to the class c_i for which $P_i[x,y]$ is maximal (see e.g., Figure 8, Box 804). In one embodiment of the invention these assignments are displayed in a separate window so the user can compare these classifications with the original image to verify system performance. After all pixels have been assigned to pixel classes, the system embodying the invention may proceed to the *Entity Classification* (e.g., stage B) of processing.

C. Entity Classification

When the system is used in Automated User mode, its goal is to assign each pixel in the image to a particular type of entity (e.g., a histological structure) based not just on color but other features of the entity as well, such as shape, texture, size, etc. The assignment of pixels to distinct pixel classes is one of the steps toward this end. In the next stage of processing, the system (i) groups pixels within a given pixel class into

"blobs," (i.e., maximal, spatially connected subsets) and then (ii) uses yet another stage of Bayesian processing, this time based on blob morphology, to assign each blob to its most probable entity class.

1. *Partitioning pixel classes into blobs (e.g., maximal spatially connected subsets):*

The first step in entity classification is to partition each pixel class c_i into maximal, spatially connected subsets (i.e., *blobs*) of pixels (see e.g., Figure 8, block 810). A set B of pixels is *connected* in class c_i if $B \subset c_i$, and any pixel in B can be reached from any other pixel in B by a sequence of single-pixel, vertical or horizontal steps without leaving B. B is *maximal* if there is no strict superset of B that is connected in c_i. In practice, one "grows" blobs by (i) initializing the new blob to be a pixel in class c_i that has not yet been included in any maximal blob, and then (ii) recursively including in the new blob any pixel in c_i that is horizontally or vertically adjacent to some pixel that has already been included in the new blob.

2. Application of blob (maximal, spatially connected subset) measures:

To each such subset B (called a *blob*) the system now applies a battery of morphologically sensitive functions, $\phi_1, \phi_2, \ldots, \phi_q$, called *blob measures (e.g., at block*

812). A *blob measure* is a function whose value depends on the pattern of pixel values within, or in the neighborhood of, the given blob. Some examples of blob measures are

- the total number of pixels composing the blob
- the length of the blob's boundary divided by the total number of pixels in the blob.
- the mean level of chromatic measure $\lambda_i(x,y)$ over all pixels (x,y) within the blob. (Note that to compute this measure requires access to the chromatic information in the original image)
- the total number of pixels assigned to pixel class c_j that lie within a distance of 20 pixels of the blob. (Note that to compute this measure requires access to the values of pixels outside the blob).

For a given pixel class c_i, there may be various types of entity structure (e.g., cellular structure) that might actually have produced a c_i blob *B*. Let us denote these different possible entities as $o_{i,0}, o_{i,1}, o_{i,2},\ldots, o_{i,r(i)}$. Thus, there are r(i)+1 different possible types of entities that can be composed of pixels in pixel class c_i. As a matter of convention, the system may let $o_{i,0}$ designate the class of "nonentities" (amalgams of c_i detritus that do not merit classification as any particular sort of entity).

3. Bayesian blob classification

As described above, a Bayesian classifier is used to assign pixels to pixel classes; the assignment of blobs to entity classes proceeds similarly (e.g., at step 814). In one

embodiment of the invention there are, however, important differences between the blob vs. pixel classification stages. The user is first prompted to supply the name of an entity *Zoo 816*. This Entity Zoo comprises representative samples $T_{i,j}$ of blobs from each entity class, $o_{i,j}$, i = 0, 1,..., n; j = 0, 1,..., r[i]. (i.e., $T_{i,j}$ is a set containing many examples of blobs from pixel class c_i that belong to entity class $o_{i,j}$). Also stored in the Entity Zoo are various parameters derived from the samples $T_{i,j}$.

It should be noted that these samples $T_{i,j}$ may well comprise blobs that have been obtained in the past from a range of different tissue images (e.g., images from different parts of the brain, from different patients showing different symptoms). In this respect, the Entity Zoo is likely to differ from the pixel zoo. The point here is that one expects pixel color to depend on the particular staining history of a given sample. However, the morphology of a particular histological structure of interest is likely to be largely invariant with respect to changes in the source of the image being analyzed. However, what is likely to vary systematically as a function of changes in image source is the *prior probability* of finding different varieties of entities.

I. <u>*Estimated entity class prior probabilities.*</u> For each entity class $o_{i,j}$, the prior probability $p[o_{i,j}]$ is the proportion of c_i blobs in the current image that the system expects (based on previous experience) to belong to class $o_{i,j}$. Such factors as brain region of sample, genetic information, demographics, sex, disease presence, disease subtype, subtype of individual (including race), disease severity,

prior medical history, etc. are used (e.g., in the context of a general linear model) to estimate $p[o_{i,j}]$ from the entity zoo. In addition entities may be compared with other non-visual data (e.g., genetic information, demographics, sex, disease presence, disease subtype, severity of the disease, subtypes of individuals including race, disease severity, prior medical history, genetic profiles). Entities can also be compared to data sets derived from similar sources containing genetic profiles of individuals (e.g., gene fingerprints).

II. *Estimated entity class definitions.* Suppose our blob measures are $\phi_1, \phi_2, \ldots, \phi_q$, and define the vector-valued function of ϕ of blob-measures by

$$\phi(B) = (\phi_1(B), \phi_2(B), \ldots, \phi_q(B)) \qquad (2)$$

for any c_i blob B. Associated with each entity class $o_{i,j}$ is a conditional probability density $f(w| o_{i,j})$. For any blob-measure vector w, $f(w| o_{i,j})$ gives the probability density that a blob in class $o_{i,j}$ will have blob-measure vector w. That is, for any c_i blob B, $f(w| o_{i,j})$ is the probability density that $\phi(B) = w$, given that B is in entity class $o_{i,j}$. The *definition of entity class* $o_{i,j}$ is a parametric approximation of $f(w| o_{i,j})$ derived from the sample $T_{i,j}$.

Given (i) the *a priori* probability $p[o_{i,j}]$ that a given c_i blob belongs to class $o_{i,j}$, and (ii) the conditional probability density $f(w|o_{i,j})$ that a blob in class $o_{i,j}$ is assigned blob-measure vector w, Bayes' Theorem is now used for each c_i blob B to compute the posterior probability (see e.g., figure 2, block 814),

$$P_{i,j}[B] = \frac{p[o_{i,j}]f(\phi(B)|o_{i,j})}{\sum_{k=0}^{r[i]} p[o_{i,k}]f(\phi(B)|o_{i,k})} \qquad (3)$$

Given our previous knowledge, and the results of applying the vector-valued function of blob measures to B, $P_{i,j}[B]$ gives the probability that B is actually an entity of type $o_{i,j}$. We now assign B to whichever entity class, $o_{i,j}$, $j = 0, 1, \ldots, r(i)$, it most probably belongs.

In one embodiment of the invention, the classified image is now returned as output (e.g., step 820). In other embodiments of the invention, the blob classifications achieved in this stage of processing are treated as tentative, rather than final, and are channeled into a second phase of pixel-classification in which the original assignments of pixels to different classes are subject to revision in light of the tentative entity classifications. The output from this second stage of pixel classification is then submitted to another stage of blob-classification. This process may recur several times before a final classification is returned.

Independent User Mode Operation:

When the system embodying the invention is used in Automated User mode, the input is a digitized image, and the output is an image containing blobs that have been classified as various sorts of histological entities. Before the system can be operated in Automated User mode, however, the pixel classes, c_i , i = 0, 1,..., n, and entity classes $o_{i,j}$, i = 1, 2,.... n; j = 0, 1,..., r(i), should be defined. In one embodiment of the invention, defining the pixel and entity classes (e.g., building a product or evolving algorithm) is the purpose of operating the system in Independent User Mode. Figure 9 illustrates the processes associated with the independent user mode in accordance with one embodiment of the invention. Input for the independent user mode is typically retrieved interactively from an archive of digitized images (e.g., 900) specified by the user. Output comprises:

(1) a *Pixel Zoo* (e.g., 918) comprising representative samples S_i, i = 0, 1,..., n, of pixel-measure vectors from each pixel class,

(2) *Pixel class Definitions* based on the pixel zoo samples (e.g., 901) S_i, (i.e., parametric estimates of the conditional densities $f(v|c_i)$ of obtaining pixel-measure vector v, given that v is generated by a pixel in pixel class c_i),

(3) an *Entity Zoo* (e.g., 919) comprising many representative samples $T_{i,j}$ of blobs from each entity class, and

(4) *Entity Class Definitions* based on the entity zoo samples $T_{i,j}$ (i.e., parametric estimates of the conditional densities $f(w|c_{i,j})$ that $\phi(B) = w$, given that B is an entity of type $o_{i,j}$).

A. Pixel Zoo generation:

After having obtained a new digitized, tissue sample image (e.g., at block 900, which executes as described above with respect to block 800 of Figure 8). The system configured in accordance with one embodiment of the invention prompts the user to either (i) provide a sample S_i of pixels belonging to each of the classes c_i, i = 0, 1,..., n (where n is specified by the user), or else to (ii) read in the parameters defining conditional densities, $f(v|c_i)$, which have been previously obtained from a similar tissue sample and stored along with an associated pixel zoo (e.g., 901).

If it is necessary to estimate conditional densities $f(v|c_i)$ from the current sample, the system may obtain a sample set as follows: For a given class c_i, the user selects the required S_i by mouse-clicking several regions of the image filled with pixels from class c_i (e.g., at block 902). The sample S_i may be referred to as the *zoo sample of pixel class i*.

The system may use a flood-fill procedure to grab all pixels in the neighborhood of the mouse-clicked pixel whose pixel-measure vectors are similar to the pixel-measure vector of the clicked pixel, at the same time showing the user exactly which pixels have been included in the sample. Alternatively, an eyedropper procedure may be used to add individual pixels to the sample S_i.

After zoo samples (e.g., a sample set) have been collected for each pixel class, The system estimates the conditional densities $f(v|c_i)$, i = 0, 1,..., n from the obtained samples (e.g., at block 904).

If the pixel classes being defined in the current application of the system are completely new, then prior probabilities $p[c_i]$, i = 0, 1,..., n are taken (by default in one embodiment of the invention) to be uniform: i.e., $p[c_i] = \frac{1}{n+1}$, i = 0, 1,..., n. Typically, however, previously classified images will be available from which it is appropriate to derive estimates of prior probabilities. This will be the case, for example, when the previous images are of the same type of tissue as the current images, and are stained with the same combination of chromogens as was used for current images. If the only differences between the current image and previously classified images involve depth of staining, for example, then pixel classes in the current sample are expected to be generated by the same types of histological entities as were the pixel classes in the previous samples. In this case, the user can supply the name of the image archive from

which priors are to be estimated. Prior probabilities are then estimated by setting $p[c_i]$ equal to the proportion of pixels in the specified image population that were assigned to class c_i.

The system proceeds to apply Eq. (1) to the pixel-measure vectors of pixels in the current image (e.g., at block 906), and to assign each pixel to its most probable pixel class (e.g., at block 908). The classified image is now presented, (e.g., side by side) with the original, so that the user can check that the classification is correct (e.g., at block 910). If the classification is incorrect or has room for improvement in the opinion of the user (e.g., at block 912), the user provides feedback to the system, indicating how misclassified pixels should have been classified (e.g., at block 914).

Based on this feedback, the system (1) moves misclassified pixels from their current pixel zoo samples to the correct samples, (2) revises its estimates of conditional densities $f(v|c_i)$, i = 0, 1,..., n (e.g., at block 916) in view of the feedback obtain from the user. The user also has the option of adjusting the estimates of prior probabilities to reflect the proportions of pixels assigned to the different pixel classes in the current image. However, if estimates of priors were originally based on a large sample of previously classified images, then the user may prefer to retain the current estimates without alteration (see e.g., at block 911).

Then the system applies Eq. (1) once again to every pixel value I[x,y] in the image (e.g., executes block 906), and once more assigns each pixel to its most likely

pixel class (e.g., block 908). Then the reclassified image is presented once more (e.g., side by side with the original) for the user to check veracity (e.g., block 910).

This process repeats until the user is satisfied with the classification. After the user has ratified the classification, the Pixel zoo Z_{pixels} is stored as output (e.g., 918). Z_{pixels} comprises

I. the samples S_i, i = 0, 1,..., n. (Each sample S_i contains many pixel-measure vectors belonging to pixel class c_i.)

II. the prior probability estimates, $p[c_i]$, i = 0, 1,..., n.

III. the estimated conditional densities $f(v|c_i)$, i = 0, 1,..., n.

Once the pixel zoo has been produced and stored, the system proceeds to Entity Zoo construction.

B. Entity Zoo construction and entity definition:

As when the system is operated in Automated User Mode, the image is now partitioned into blobs based on pixel class (e.g., at block 920), and for each blob B, $\phi(B)$ is computed (Eq. (2)) (e.g., at block 922).

1. Entity Zoo initialization:

The pixel-classified image is presented to the Independent user for feedback (e.g., side by side with the original, digitized image) (e.g., at block 912). Then for each pixel class c_i, the user begins by indicating ((e.g., at block 924) with mouse clicks or other input) several blobs (e.g., approximately 5 in one embodiment of the invention, but the system may use more or less) in entity class $o_{i,0}$, then several in class $o_{i,1}$, then several in class $o_{i,2}$, etc. successively for each entity class in pixel class c_i. (It may be that more than one image must be accessed in order to obtain a sufficient number of entity examples in each class.) Let $T_{i,j}$ be the sample of blobs selected by the Independent user as examples of entities belonging to class $o_{i,j}$ (e.g., at block 926).

In addition to initializing the entity zoo, the system may also need to initialize the *a priori* probabilities of different entity classes. For i = 1, 2,..., n; j = 0, 1, 2,..., r(i), the *a priori* probability $p[o_{i,j}]$ that a randomly chosen blob in pixel class c_i is actually an entity of type $o_{i,j}$ is initialized to the uniform distribution. That is, the system may initially set $p[o_{i,j}] = \frac{1}{r(i)+1}$.

2. Definition estimation:

Our target is an adequate estimate of the function $f(wlo_{i,j})$, which is called the *definition* of entity class $o_{i,j}$. For any blob B in pixel class o_i, $f(wlo_{i,j})$ gives the conditional probability density of the vector value $w = \phi(B)$, given that B is in class $o_{i,j}$.

The system can base a current estimate on the examples currently in the entity zoo, and iteratively refine this definition by adding new examples of different entities to appropriate entity zoo samples, $T_{i,j}$.

For each entity zoo sample $T_{i,j}$, i = 1, 2,..., n; j = 0, 1,..., r(i), The system computes the vector-valued function $\phi(B)$ of blob measures for each blob B assigned to $T_{i,j}$. This yields sample of (q-dimensional) points $w = \phi(B)$ that is now used as the basis for a parametric estimate of $f(wlo_{i,j})$ (which may be derived, for example, using a variant of the EM algorithm) (e.g., at block 928). The estimated function $f(wlo_{i,j})$ has the following porperties: (1) $f(wlo_{i,j})$ is non-negative for all $v \in \Re^q$, (2) the integral of $f(wlo_{i,j})$ over all $w \in \Re^q$ is equal to 1, and (3) $f(wlo_{i,j})$ takes high values in regions of $\Re^q$ containing values $\phi(B)$ for many blobs B assigned by the Independent user to class $T_{i,j}$, and low values elsewhere.

3. Entity classification (e.g., block 930)

Once the system has an estimate of the definition $f(wlo_{i,j})$ for each entity class $o_{i,j}$, these definitions are applied in the context of a Bayesian classification procedure in order to classify the blobs, either in the current image, or else in a new image.

For each c_i blob B in the current image, B is classified using Bayes' Theorem (Eq. (3)) to obtain for each entity class $o_{i,j}$ the posterior probability $P_{i,j}[B]$ that B is in class $o_{i,j}$. Given the systems previous knowledge, and the results of applying morphological

measures to B, $P_{i,j}[B]$ gives the probability that B is actually an entity of type $o_{i,j}$. The system proceeds to assign B to whichever entity class, $o_{i,j}$, $j = 0, 1, \ldots, r(i)$, B most probably belongs.

4. User validation and zoo expansion

The classified image is presented to the user for feedback. For instance, the classified image can be presented with each blob color-coded to signal the entity class to which it has been tentatively assigned (e.g., at block 932). The user reclassifies any obviously misclassified blobs (e.g., at block 934) that he/she detects by selecting them with the mouse and indicating their proper classes. The blobs singled out by the user as having been misclassified are added to the correct entity zoo samples (e.g., at block 935).

If the Independent user judges that all of the remaining blobs in the image have been correctly classified, (e.g., at block 933) he/she can instruct the system to include all blobs in the entity zoo samples corresponding to the entity classes to which they have been assigned.

Alternatively, if many errors remain in the tentative classification produced by the system, the Independent user can select individual blobs for inclusion in one or another entity zoo sample.

Prior probabilities may now be recomputed. If the proportions of blobs included in the various entity zoo samples may be assumed to approximate the proportions in the

population at large, then the Independent user may instruct the system to base its new estimate of the prior probabilities on the updated zoo samples. In this case, one embodiment of the system uses a general linear model to estimate $p[o_{i,j}]$ as a function of the information associated with the current image (e.g., sex, diagnosis and age of death of patient, region of brain from which the sample was taken, etc.).

Alternatively, if the Independent user judges that the sizes of the entity zoo samples do not reflect the proportions of different types of entities in the population at large, the Independent user may opt to continue using the previous prior distribution.

5. Termination

The system iterates stages Definition estimation, Entity classification, and User validation and zoo expansion until the user terminates the process (typically, when the Independent user is satisfied that the system automatically classifies new entities correctly on the basis of the entity definitions derived from the entity zoo samples). At this point the system produces as output the entity zoo $Z_{entities}$. $Z_{entities}$ comprises

I. the samples $T_{i,j}$, i = 0, 1,..., n, j = 0, 1,..., r[i] (Each sample $T_{i,j}$ contains many blobs belonging to entity class $o_{i,j}$.) Associated with each blob in $T_{i,j}$ is all the information about the source of the tissue from which it was derived.)

II. the prior probability estimates, $p[o_{i,j}]$, i = 0, 1,..., n, j = 0, 1,..., r[i].

III. the estimated conditional densities $f(w|o_{i,j})$, i = 0, 1,..., n, j = 0, 1,..., r[i].

The pixel zoo (e.g., 918) and entity zoo (e.g., 936) output generated by the system in cooperation with feedback from the user is referred to in one embodiment of the invention as a product algorithm, and such output may be applied to multiple images likely to contain entities to be classified.

Neural Network Engine:

As mentioned above, the system may comprise a neural network engine configured to evaluate image data. The detailed aspects of the neural network engine and the functionality associated therewith will now be described in further detail. A specific instance of image processing (classifying histological structures in brain slices) is utilized for illustrative purposes. However, the same technique is applicable to processing and classifying any other type of image data.

The neural network is configured to classify entities in image data (e.g., histological structures such as senile plaques). In this instance the neural network utilizes Fourier shape descriptors of plaque entity boundaries as inputs, and is evolved via genetic algorithms, rather than trained (although it may be trained). When a spatially connected subset is presented, the neural network classifier engine traverses the perimeter of the spatially connected subset and derives relative harmonic amplitudes from the perimeter.

Then, the neural network classifier accepts the relative harmonic amplitudes and returns the index of the output neuron that gives the largest value as the classification result for the spatially connected subset. In one embodiment of the invention, the network is pre-trained through genetic algorithms with a small set of training data. The results are presented to the user so that the user can confirm each classification result, and if the classification is wrong, train the network through back-propagation by indicating the correct classification. The user also can save and load the network that he/she trained for his/her later use. Over time the systems ability to accurately classify entities in an image will improve. Embodiments of the invention utilize a set of one or more evolving algorithms linked together to analyze features of the image data based on the identification information provided by the user. For instance, the system may utilize the entity classification algorithms described above alone or in combination with the neural network engine.

Neural Network Image Processing Example:

A specific example of an embodiment of the invention implemented in computer software to isolate, classify, and count entities in digitized images of histological structures will now be described. The reader should note, however, that the same techniques may be utilized to process any type of image data comprising entities. In this example, each histological section has entities such as senile plaques or tangles and the invention provides a way to count the number of senile plaques and tangles in the

histological image. Histologists and the computer application often disagree when it comes to the classification of plaque-type entities, which are initially classified by pixel color (the way many current systems operate). The disagreement arises when it comes to deciding how many plaques the identified entity contains. The neural network classifier described herein narrows the gap between histologists and the computer application.

Given the image of a histological entity, the main task of the entity classifier is to tell if it is a single entity or multiple entity, and moreover, to determine how many overlapping sub-entities the entity is made of. For instance, the system executing an embodiment of the invention can distinguish single entities from multiple entities. Among a variety of measures suitable for this purpose, the shape information of an entity's perimeter helps determine how many entities are present or whether there is any overlap. The system may acquire this information in terms of Fourier descriptors of an entity's perimeter. The system may also be configured to acquire information such as an entities size, shape, color, texture, or other distinguishing features. Once the system obtains the information it may utilize for entity classification, it executes an algorithm to process that data that is stochastically robust. In one embodiment of the invention, the system passes feature information (e.g., relative harmonic amplitudes) to a neural network. A set of connection weights on the neural network is determined via genetic algorithms, which can effectively search a huge space so that a globally optimal, or nearly optimal, set of connection weights will be found.

Fourier Descriptors:

Fourier descriptors may be utilized to analyze the shape information of closed curves. Assume that $z(l)$ describes a closed curve in the complex plane, where $z(0)$ is a starting point that can be chosen arbitrarily and l is the length of the curve traced counterclockwise from the starting point. Further assume that L is the length of the whole curve so that $z(0) = z(nL)$ for any integer n. Then $z(l)$ can be represented as a series of complex exponentials.

$$z(l) = \sum_{n=-\infty}^{+\infty} z_n e^{j\omega n l} = z_0 + \sum_{n=1}^{+\infty} \{ \underbrace{z_{-n} e^{-j\omega n l} + z_n e^{j\omega n l}}_{elli_n(l)} \},$$

where $\omega = 2\pi/L$ and z_n, called an n-th *Fourier descriptor* or *harmonic element* for $n \in \{-\infty,...,0,...,\infty\}$ is a complex number. In this example, z_0 is the center of gravity of the curve; thus an embodiment of the system can ignore z_0 as it is typically uninformative about the shape of $z(l)$. Each term

$$z_{-n} e^{-j\omega n l} + z_n e^{j\omega n l}$$

describes an ellipse. Thus, a pair of Fourier descriptors, z_n and z_{-n} is called an *elliptic Fourier descriptor*. The ellipse, $elli_n(l)$, is covered n times while l changes from 0 to L.

As mentioned, z_n for $n \in \{-\infty,...,0,...,\infty\}$ is a complex number; thus,

$$z_n = \mathrm{Re}(z_n) + j \times \mathrm{Im}(z_n)$$
$$= |z_n| e^{j\Phi_n},$$

where

$$\mathrm{Re}(z_n) = |z_n| \cos(\Phi_n), \quad \textit{and}$$
$$\mathrm{Im}(z_n) = |z_n| \sin(\Phi_n).$$

$|z_n|$ is called an *n*-th *harmonic amplitude*, and ϕ_n is an *n*-th *harmonic phase.* In each ellipse, *elli*$_n$, there are two harmonic amplitudes and phases, $|z_{-n}|$, $|z_n|$, ϕ_{-n}, and ϕ_n. In general, $|z_{-n}|$ and $|z_n|$ together determine the size of the ellipse. More precisely, the sum of these two values is the long radius of the ellipse, and the difference of these two is the short radius. On the other hand, ϕ_{-n} and ϕ_n determine the orientation of the ellipse.

In practice, Fourier descriptors are calculated by a discrete Fourier transform algorithm after extracting an *N*-point boundary, $\{z(kL/N)\}$, where *k* ranges from 0 to *N*—*1*. The larger *N* is, the more precise the Fourier descriptors become. The size of *N* may be dictated by time and memory constraints and N should therefore not be too large. It is also convenient to make *N* a power of two because fast Fourier transform algorithms can be effectively implemented in that case. Once the system obtains Fourier descriptors of a

given closed curve, the system can reconstruct the curve from its Fourier descriptors. The more descriptors the system use, the more closely the system can approximate the original curve. Figures 13, 14 and 14 are reconstructed outline curves of Figure 12 (element 1200). The difference among these three is the number of harmonics used. These closed curves (e.g., 1300, 1400, and 1500) may be described as

$$z_k'(l) = \sum_{n=1}^{k} elli_n(l),$$

where k =10 for Figure 13, k=20 for Figure 14, and k=30 for Figure 15. If the system uses only low order descriptors, the reconstruction of the curve tends to exclude fine detail.

Fourier Descriptors of Plaque-like Entities

Histological entities (e.g., cells, nuclei, neurons, astrocytes, senile plaques) often take very complicated, distorted shapes with ragged edges. However, the raggedness is usually indicative of noise the system can filter out and contributes primarily to higher order harmonic elements. Thus, for the pattern recognition of those entities, only the lower order harmonic elements are used in one embodiment of the invention. Moreover, harmonic amplitudes are typically more vital than harmonic phases. Harmonic phases are very sensitive to starting points, $z(0)$. Even if two entities are of the same shape and size, harmonic phases for one are different from those of the other if one entity is a rotated image of the other. However, harmonic amplitudes of the one are identical to those of the other under such conditions. Thus, an embodiment of the

invention focuses attention on harmonic amplitudes although the use of harmonic phases may be justified by considering the shifts of phases relative to ϕ_1, i.e., $\phi_n - \phi_1$.

If the system is solely interested in the shapes of the entities, the system can further simplify the matter. As mentioned earlier, $|z_{-n}|$ and $|z_n|$ together determine the size of the ellipse, $elli_n(t)$. In fact, $|z_1|$ and $|z_1|$ together usually give a rough estimate of entity size.

However, the information of entity size is obtained in one embodiment of the invention by counting pixels. Thus, by making all $|z_n|$'s relative to the largest one, the system can simplify the neural network entity classifier. Some merits of this conversion are that the magnification scale of images becomes less important and an optimal set of connection weights becomes easier to obtain because the neural network classifier may work with input values from the restricted domain, [0,1].

Figures 17 and 19 show relative descriptor amplitudes of plaque (e.g., entity 1600 & 1800) samples shown in Figure 16 and 18, respectively. Top rows A show $|z_n|$, bottom rows B show $|z_{-n}|$, and n ranges from 1 to 30 from left to right. In both cases, $|z_1|$ is the largest amplitude, and all other amplitudes are made relative to it.

These Figures illustrate that in one embodiment of the invention only lower order harmonic amplitudes make any significant contribution to the shapes. Second, Figures 17

& 19 contain useful information to help distinguish these two shapes. Note in particular that both $|z_1|$ and $|z_3|$ are substantially larger in Figure 19 than in Figure 17. Indeed, this is usually true when the system compares a double plaque entity to a single plaque entity. $|z_3|$ tends to be larger when a shape is elongated rather than circular, and $|z_1|$ tends to be larger for shapes that deviate from ellipses by being pinched on opposite sides. Such shapes are marked by opposing concavities such as are evident in Figure 18.

Identifying entities that are made of three or more overlapping plaques is not this easy. Because there are so many topological variations in their shapes, two entities in different classes may happen to take a similar shape. Even though they are different to our eyes, they may show a similar spectrum of harmonic amplitudes. Figure 21 shows the descriptor amplitudes (A, B) obtained from the plaque image (2000) in Figure 20.

Another problem is that higher order harmonics will contribute to the shapes of compound plaques. Those higher order harmonics may be considered as noise, and thus ignored mistakenly. As a result, those entities may be misclassified. However, note that their descriptor amplitudes are still clearly different from descriptor amplitudes of single plaques as is evident from Figures 17 and 21. Therefore, the system can easily distinguish them from single plaques.

Neural Network Entity Classifier:

A neural network may be utilized to aid the system in allowing a set of connection weights evolve by genetic algorithms, rather than training such connection weights by back propagation. Genetic algorithms can search a huge space for globally optimal, or nearly optimal, solutions. By contrast, back propagation is a *hill-climbing* training method, which is simple, straightforward, but likely to get stuck with a locally optimal set of connection weights.

Genetic algorithms are search algorithms based on natural selection. They maintain a population of individuals $P(t)=\{x_{1,t}, \ldots, x_{n,t}\}$ for generation t. Each $x_{i,t}$ represents a potential solution to a given problem. Each potential solution is evaluated to give some measure of its fitness. Then, the new population $P(t+1)$ is formed by selecting the fitter potential solutions from $P(t)$. Some new individuals undergo transformations by genetic operators, such as mutation and crossover. After some number of generations, the population converges such that the best individual in the population represents a nearly optimum solution.

In a typical feed-forward neural network, an input to a neuron, except to input neurons, is a weighted sum of all outputs from the neurons on the previous layer. Those weights are called connection weights. These parameters determine the behavior of the neural network.

Genetic Algorithm for Neural Network

Genetic algorithms typically utilize a simple data representation which is commonly referred to as a *chromosome*, and to which genetic operations, such as mutation and crossover, can be applied. In this approach, each connection weight is represented in a 32 bit long vector (although other bits lengths may be utilized). With this 32 bit long vector, the system represent a real number ranging from -128 to +128 with 2^{-24} step width, to narrow down the search space for practicality. All connection weights are concatenated so that they form a chromosome which is actually a long bit vector. The number of input, output, and hidden layer neurons are fixed in our approach; therefore, each chromosome is a bit vector of fixed length. Mutation is a random change on a randomly chosen bit of a chromosome, and crossover between two chromosomes is an exchange of corresponding bits from a randomly chosen crossover point to the end of the chromosomes.

Fitness Function

Selection by fitness is an essential part of genetic algorithms. The selection process evaluates the fitness of each chromosome, sort chromosomes by fitness, discard the bottom half of them, and duplicate the rest.

On the other hand, fitness functions typically require some elaboration in order to make a genetic search work. The system is configured to find a set of connection weights with which the neural network classifier can classify entities as correctly as possible. However, accuracy alone is hardly a sufficient fitness criterion.

Consider the following fictitious situations. If it is sunny in Southern California, say 85% of the year, every weatherman can claim that his weather forecast is 85% accurate. All that a weatherman has to do is always to say that it will be sunny tomorrow. He needs to make no calculation or analysis to produce his forecast. However, he will not be able to get a job as a weather man in San Francisco or Seattle.

A similar situation may occur in entity classification problems. For example, the majority of plaque entities to be classified happen to be single plaques. Under such a condition, the neural network classifier may evolve itself to classify every plaque entity as a single plaque if accuracy is the only criterion to measure the fitness of a set of connection weights. When the system uses classification accuracy as the only criterion to measure fitness this can occur.

One solution for this is to make the base data set for fitness evaluation comprise equal numbers of entities from all classes, and randomly select the data set for fitness evaluation from the base set every time the fitness of a chromosome is measured. This not only prevents the classifier from becoming over-fit to a particular data set, but also makes the algorithms as fool-proof as possible. Though this strategy alleviates the symptom, it is still possible to overlook a chromosome that results in a *cheater* neural network.

To reduce the likelihood of evolving cheater networks, the system introduces an additional heuristic for fitness evaluation. Specifically, the system measures the Euclidean distance between the probability distribution of plaque entities in a data set for fitness evaluation and the probability distribution of the outputs from the neural network with a given chromosome.

$$\|d_t - d_o\| = \sqrt{\frac{\sum_{i=1}^{k} (d_t(i) - d_o(i))^2}{k}},$$

where k is the number of different plaque classes, and for $i = 1,2,\ldots,k$, $d_t(i)$ gives the proportion of plaque images in the test data set belonging to class i, and $d_o(i)$ gives the proportion of images assigned to class i by the network. Since the test data set is randomly chosen for each fitness evaluation, this heuristic gives us a measure of how honestly the neural network with a given chromosome does its job.

The actual fitness of each chromosome is given by the equation:

$$fitness = error\_rate^2 \times (1 + \|d_t - d_o\|).$$

The error rate is squared and multiplied by $(1 + \|d_t - d_o\|)$ because the system typically believes that the decrease in the error rate outweighs the decrease in $\|d_t - d_o\|$. The smaller the fitness value is, the fitter the chromosome is.

Neural Network Evolution

The neural network classifier utilized in embodiments of the invention to classify plaque-like entities may comprise 20 input neurons, two hidden layers, each of which consists of 16 hidden units, and 5 output neurons. Thus, the system uses a feed-forward network with three layers of adaptive weights (the number of layers and adaptive weights may vary). The bias parameter is added to the input layer. Since networks having three layers of weights can generate arbitrary decision regions, which may be non-convex and disjoint, the resulting network can recognize any type of entity.

The neural network utilized by one embodiment of the invention accepts twenty relative descriptor amplitudes, $|z'_n|$ and $|z'_{-n}|$ for $n = 1,2,\ldots,10$, where

$$\left|z'_n\right| = \frac{|z_n|}{M},$$

where $M = \max\{\,|z_k| \mid k = \pm 1, \pm 2, \ldots, \pm 10\}$. Each output neuron corresponds to a specific class of entities. The outputs of all output neurons are compared. Then, the index of the output neuron which gives the largest value is returned as the class of the input plaque entity.

The genetic algorithm utilized in one embodiment of the invention is applied to connection weights. Since there are 672 weights, each of which is represented in a 32 bit

long vector, a chromosome in our genetic algorithm is 21,504 bits long. There are 400 chromosomes vying for survival. In one specific test, images comprising 43 single plaques, 48 double plaques, 39 triple plaques and 23 quadruple plaques were obtained. The expert user thresholded those images, calculated Fourier descriptors of each entity in the image and classified them to form a base data set for fitness evaluation in the genetic algorithm. Although the neural network can classify up to 5 classes, the expert user may provide samples for only 4 classes because the system could hardly find any plaque entities that are made up of 5 or more simple plaques. A test data set is set up at each fitness evaluation phase by randomly sampling 100 entities from the base set with replacement.

At every generation, chromosomes mutate and crossover. Next, they are evaluated by actually setting up all connections of the network from each chromosome and testing the network on a randomly chosen test data set. Then, chromosomes are sorted by their fitness values and selected. The surviving chromosomes reproduce themselves. The evolution lasts for 400 generations. After the evolution ends, the best chromosome is picked.

The neural network which has evolved in this manner can discriminate single plaques from other classes of plaque entities within the base test data set with 95% accuracy. The classifier also can classify plaque entities into three classes, i.e., single, double and other plaques, with 80% accuracy within the base test data set.

The Role of an Entity Classifier within a More General Histological Image Processing System

The neural network entity classifier has been integrated into a more general image processing system (e.g., a system for histological image processing). The host system loads the neural network classifier when it is started.

After candidate entities have been isolated, an entity classifier will come into use. Given the image of an entity, the classifier first traverses the boundary of the entity counterclockwise. Next, it calculates Fourier descriptors of the boundary using a discrete Fourier transform algorithm. Then, it feeds the relative descriptor amplitudes to the neural network and displays which class the entity belongs to. If users disagree with the classifier, they indicate which class they think the entity should belong to. Then, the input from users is sent to the neural network as a target input, and the network will adjust the connection weights just a little through a single application of error back propagation.

Fourier descriptors capture only the shape information of entities. Other information, such as size, color, texture, color gradient, and so on, will have become available by the time the entities are defined. Therefore, before applying the neural network classifier, the host system excludes some entities based on criteria other than shape. For example, tiny entities are likely to be screened out. Similarly, entities

of a faint color, even if they are not tiny, might also be rejected ahead of time.

As mentioned earlier, the majority of plaque entities to be classified are single plaques. Therefore, it is not very important for the classifier to discriminate one type of multiple plaque from another type of multiple plaque. The neural network classifier can distinguish single plaques from other classes of plaques, or vice versa, with 95% success. This level of accuracy is acceptable for our purposes.

System Extensions

The system may be modified to utilize Bayesian inference with Fourier descriptors to yield improved performance. The system may also utilize other genetic algorithms to produce neural networks. The system may also combine Fourier descriptors and some other entity measures to classify entities. Fourier descriptors give information only on the outline of a histological entity. However, the entities are not merely closed outline curves. For example, some entities have a nearly round outline, but also have a two or more dark colored cores.

Information on entity size or texture can be provided to the classifier. There is a correlation between entity size and an entity class. Thus, this information could be helpful in performing analysis of image data. For instance, multiple plaques are usually larger than single plaques. This correlation should be useful for plaque entity classification; thus, the system may therefore comprise an entity classifier which will

accept size information as well as Fourier descriptors of an entity. Other types of information may also be provided. Prior probabilities might be used in conjunction with network outputs to estimate posterior probabilities.

Embodiment of Computer Execution Environment (Hardware)

An embodiment of the invention can be implemented as computer software in the form of computer readable program code executed on one or more general-purpose computers such as the computer 1000 illustrated in Figure 10. A keyboard 1010 and mouse 1011 are coupled to a bi-directional system bus 1018 (e.g., PCI, ISA or other similar architecture). The keyboard and mouse are for introducing user input to the computer system and communicating that user input to central processing unit (CPU) 1013. For instance, the keyboard and mouse, or any other input device may be utilized to collected information from the user about an image. Other suitable input devices may be used in addition to, or in place of, the mouse 1011 and keyboard 1010. I/O (input/output) unit 1019 coupled to bi-directional system bus 1018 represents possible output devices such as a printer or an A/V (audio/video) device.

Computer 1000 includes video memory 1014, main memory 1015, mass storage 1012, and communication interface 1020. All these devices are coupled to a bi-directional system bus 1018 along with keyboard 1010, mouse 1011 and CPU 1013. The mass storage 1012 may include both fixed and removable media, such as magnetic, optical or magnetic optical storage systems or any other available mass storage

technology. The system bus 1018 provides a means for addressing video memory 1014 or main memory 1015. The system bus 1018 also provides a mechanism for the CPU to transferring data between and among the components, such as main memory 1015, video memory 1014 and mass storage 1012.

In one embodiment of the invention, the CPU 1013 is a microprocessor manufactured by Motorola, such as the 6080X0 processor, an Intel Pentium III processor, or an UltraSparc processor from Sun Microsystems. However, any other suitable processor or computer may be utilized. Video memory 1014 is a dual ported video random access memory. One port of the video memory 1014 is coupled to video accelerator 1016. The video accelerator device 1016 is used to drive a CRT (cathode ray tube), and LCD (Liquid Crystal Display), or TFT (Thin-Film Transistor) monitor 1017. The video accelerator 1016 is well known in the art and may be implemented by any suitable apparatus. This circuitry converts pixel data stored in video memory 1014 to a signal suitable for use by monitor 1017. The monitor 1017 is a type of monitor suitable for displaying graphic images such as the images to be quantified.

The computer 1000 may also include a communication interface 1020 coupled to the system bus 1018. The communication interface 1020 provides a two-way data communication coupling via a network link 1021 to a network 1022. For example, if the communication interface 1020 is a modem, the communication interface 1020 provides a data communication connection to a corresponding type of telephone line, which comprises part of a network link 1021. If the communication interface 1020 is a Network

Interface Card (NIC), communication interface 1020 provides a data communication connection via a network link 1021 to a compatible network. Physical network links can include Ethernet, wireless, fiber optic, and cable television type links. In any such implementation, communication interface 1020 sends and receives electrical, electromagnetic or optical signals which carry digital data streams representing various types of information.

The network link 1021 typically provides data communication through one or more networks to other data devices. For example, network link 1021 may provide a connection through local network 1022 to a host computer 1023 or to data equipment operated by an Internet Service Provider (ISP) 1024. ISP 1024 in turn provides data communication services through the world wide packet data communication network now commonly referred to as the "Internet" 1025. Local network 1022 and Internet 1025 both use electrical, electromagnetic or optical signals that carry digital data streams to files. The signals through the various networks and the signals on network link 1021 and through communication interface 1020, which carry the digital data to and from computer 1000, are exemplary forms of carrier waves for transporting the digital information.

The computer 1000 can send messages and receive data, including program code, through the network(s), network link 1021, and communication interface 1020. In the Internet example, server 1026 might transmit a requested code for an application program through Internet 1025, ISP 1024, local network 1022 and communication interface 1020. The user may therefore operate an interface to the image processing system from a

remote location. Aspects of the invention may be embodied in server 1026 or a client computer connected to the network. Processing may occur on server 1026, computer 1000, or any other computer and the result can be delivered to the user via the network. The invention therefore contemplates the use of web-based system and/or client-server based systems embodying the invention. Alternatively, a single computer may function as a stand-alone device adapted to execute the image processing system described herein.

The computer systems described above are for purposes of example only. An embodiment of the invention may be implemented in any type of computer system or programming or processing environment. When a general-purpose computer system such as the one described executes the process and process flows described herein, it is configured to provide a mechanism for automating the expert quantification of image data.

Thus, a method and apparatus for generating special-purpose image analysis algorithms based on the expert quantification of image data is described. Particular embodiments described herein are illustrative only and should not limit the present invention thereby. The claims and their full scope of equivalents define the invention.

CLAIMS

What is claimed is:

1. In a computer system, a method for automating the expert quantification of image data using a product algorithm comprising:

obtaining a product algorithm for analysis of a first set of image data wherein said product algorithm is configured to recognize at least one entity within said first set of image data via a training mode that utilizes iterative input to an evolving algorithm obtained from at least one first user, wherein said training mode comprises:

presenting a first set of said at least one entity to said user for feedback as to the accuracy of said first set of identified entities;

obtaining said feedback from said user;

executing said evolving algorithm using said feedback;

presenting a second set of said at least one entity to said user for feedback as to the accuracy of said second set of identified entities;

obtaining approval from said user about said second set of entities; storing said evolving algorithm as a product algorithm;

providing said product algorithm to at least one second user so that said at least one second user can apply said product algorithm against a second set of image data having said at least one entity.

2. The method of claim 1 wherein said evolving algorithm comprises a neural network.

3. The method of claim 1 wherein said evolving algorithm comprises a classification engine.

4. The method of claim 1 wherein said product algorithm comprises a pixel zoo.

6. The method of claim 1 wherein said product algorithm comprises an entity zoo.

7. A computer program product comprising:

a memory medium embodying computer readable program code for automating the expert quantification of image data, said computer readable program code configured to:

obtain image data having a plurality of chromatic data points;

identify which of said plurality of chromatic data points comprise an entity;

group said plurality of chromatic data points into a plurality of spatially connected subsets;

determine a plurality of characteristics about said spatially connected subsets;

pass said plurality of characteristics to a classification engine;

classify said plurality of spatially connected subsets into at least one classification;

obtaining affirmation of the veracity of said at least one classification from a user;

evaluate said spatially connected subset to derive a set of relative harmonic amplitudes;

pass said relative harmonics into a neural network, wherein said neural network is trained to classify said spatially connected subsets using shape information provided by said set of relative harmonic amplitudes;

present a result of said classification to said user;

obtain verification of said classification from said user;

using said verification to adjust said neural network.

EXHIBIT I

ABSTRACT

Provides quantitative data about a two or more dimensional image. Classifies and counts number of entities an image contains. Each entity comprises a structure, or some other type of identifiable portion having definable characteristics. The entities located within an image may have different shape, color, texture, etc., but still belong to the same classification. Alternatively, entities comprising a similar color/texture may be classified as one type while entities comprising a different color/texture may be classified as another type. May quantify image data according to set of changing criteria and derive one or more classifications for entities in image. I.e., provides a way for a computer to determine what kind of entities (e.g., entities) are in image and counts total number of entities visually identified in image. Information utilized during a training process may be stored and applied across different images.

EXHIBIT I

Figure 1

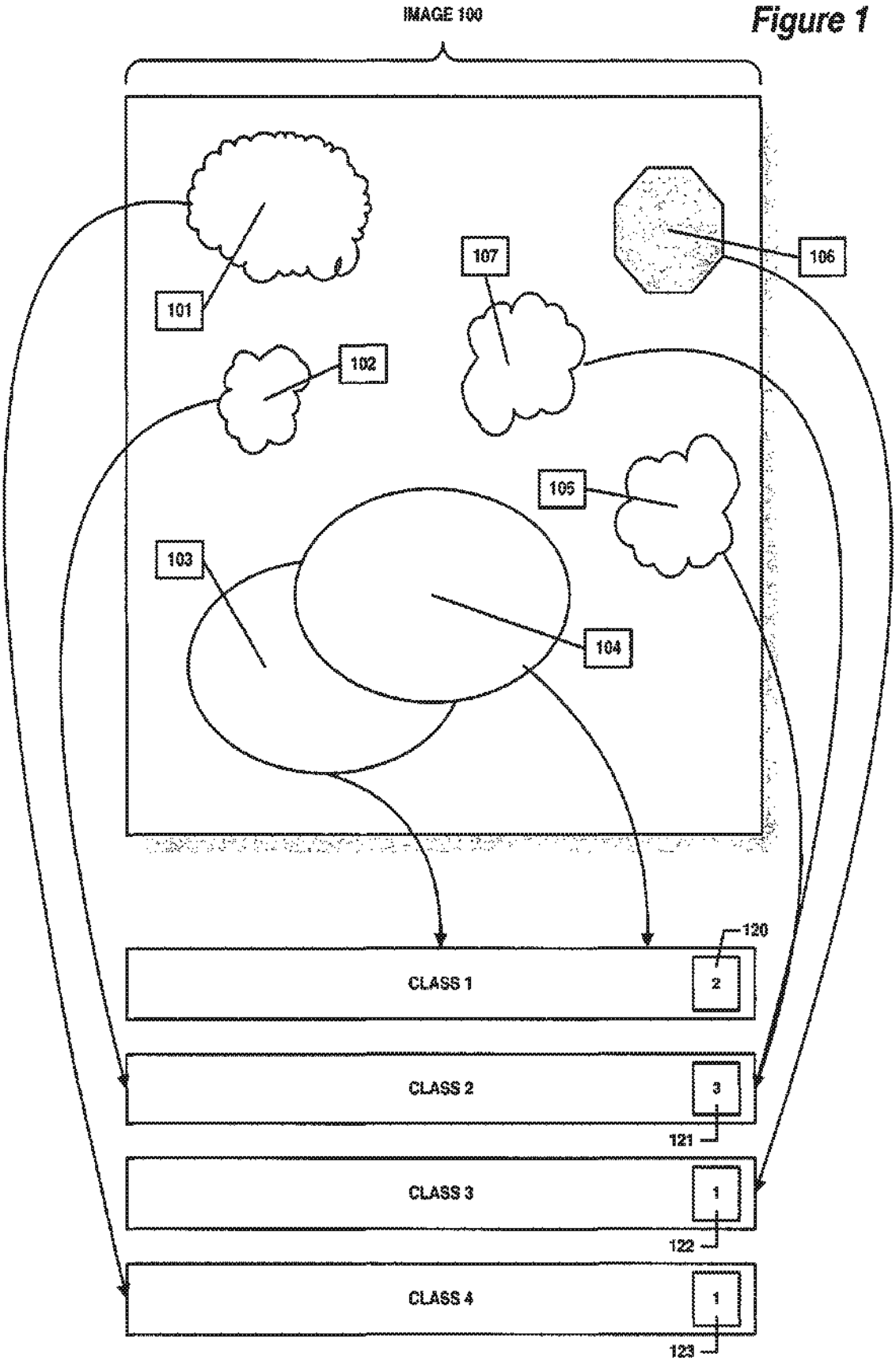


EXHIBIT I

Figure 2

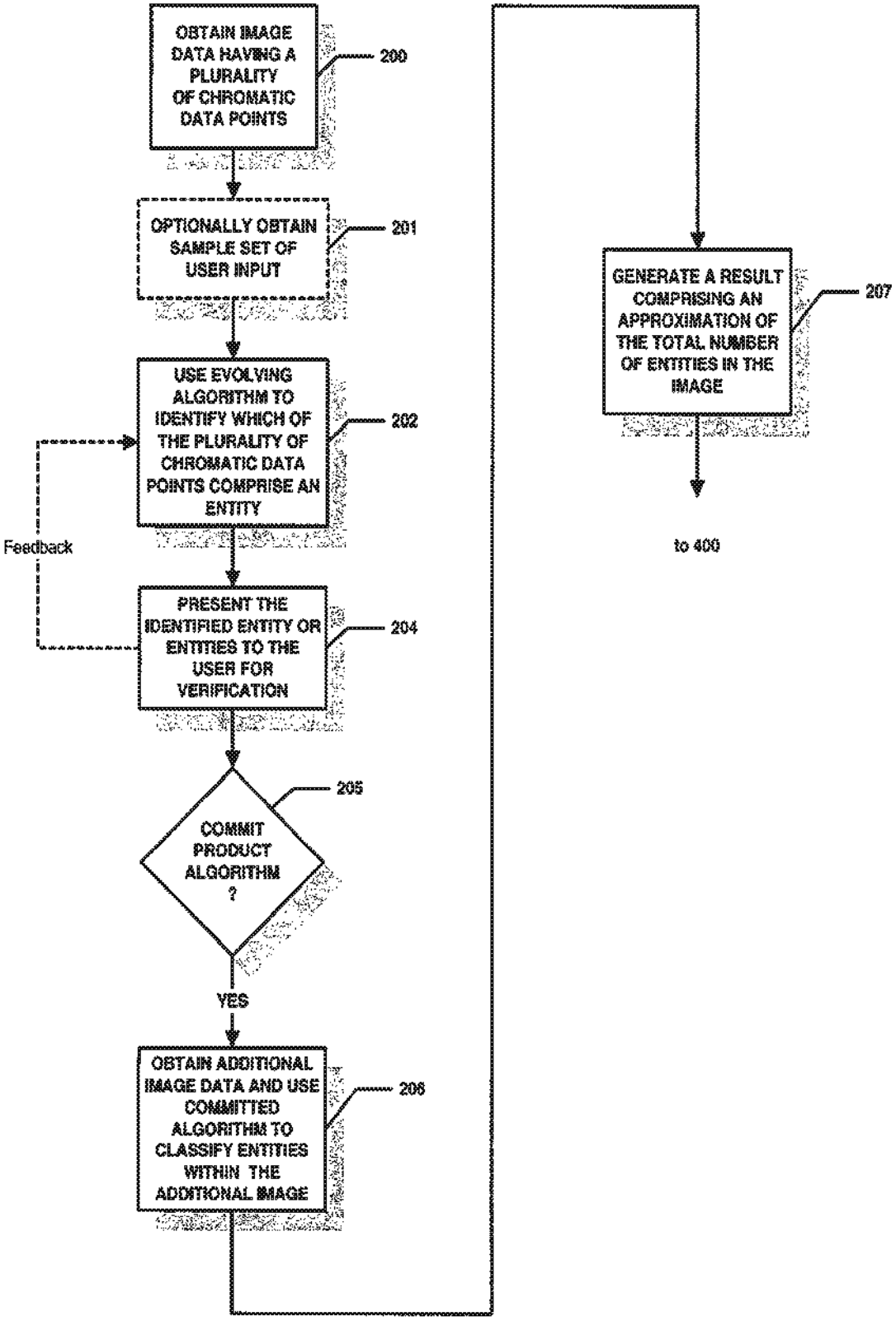


EXHIBIT I

Figure 3

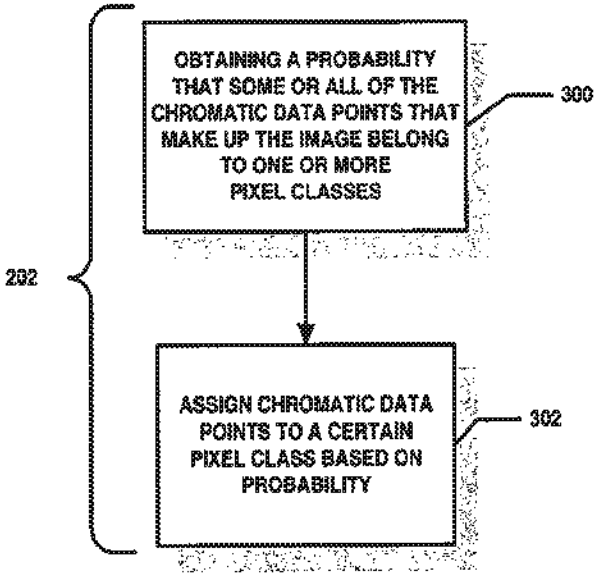


Figure 4

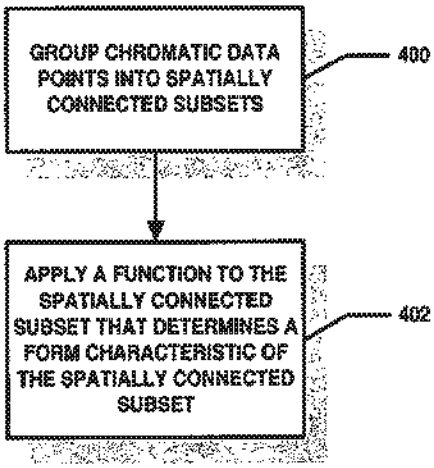


EXHIBIT I

Figure 5

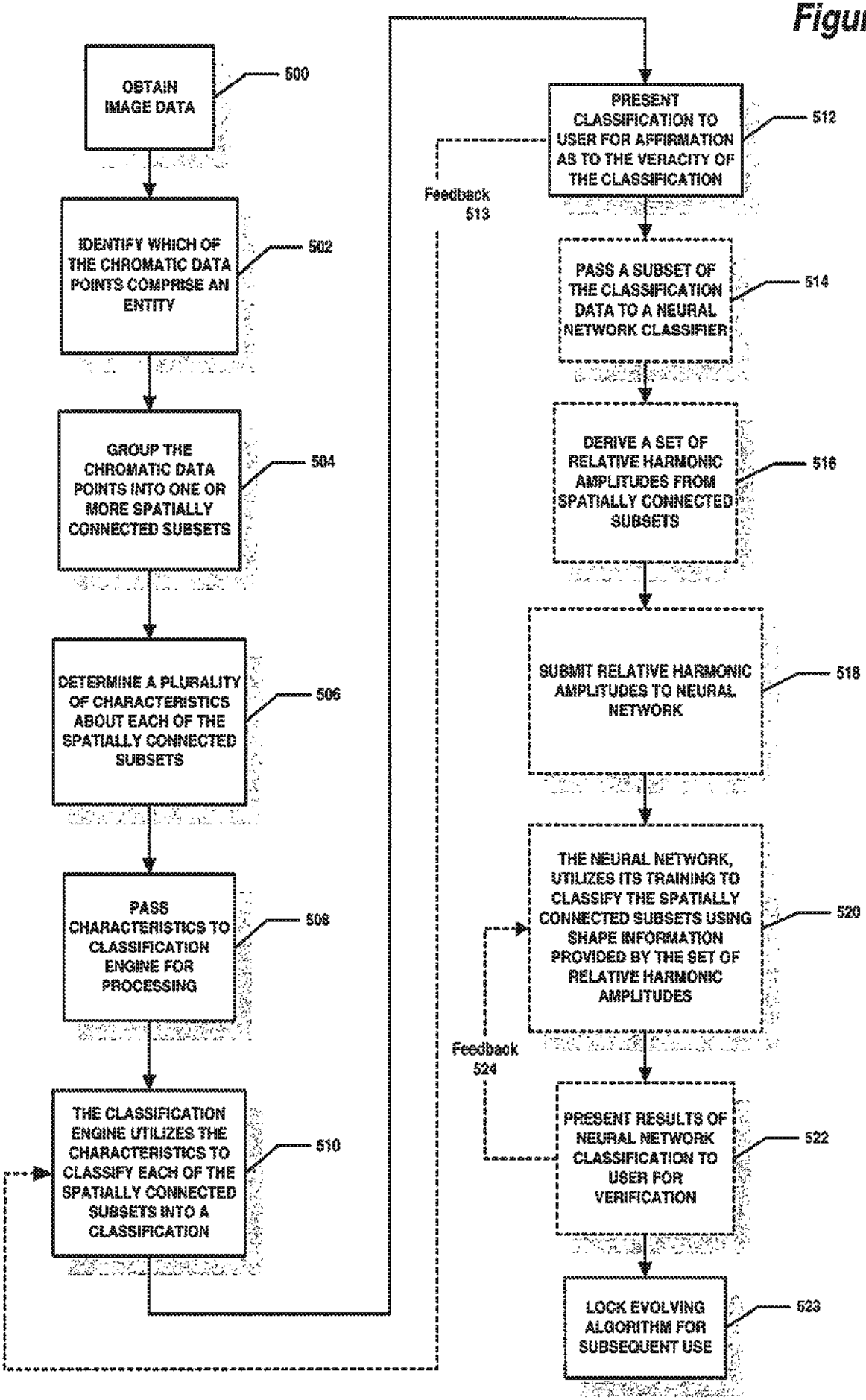


EXHIBIT I

Figure 6

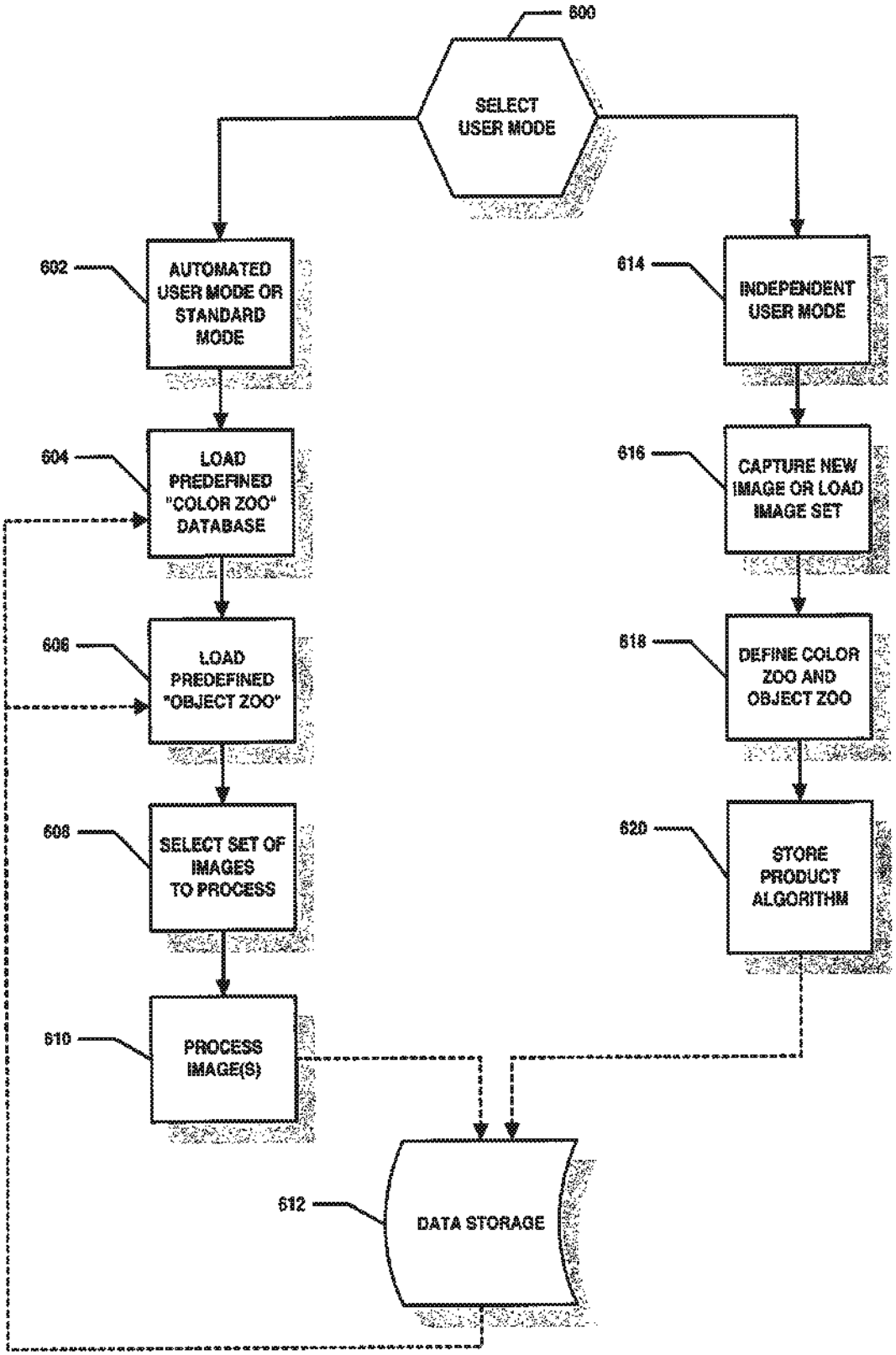


EXHIBIT I

Figure 7

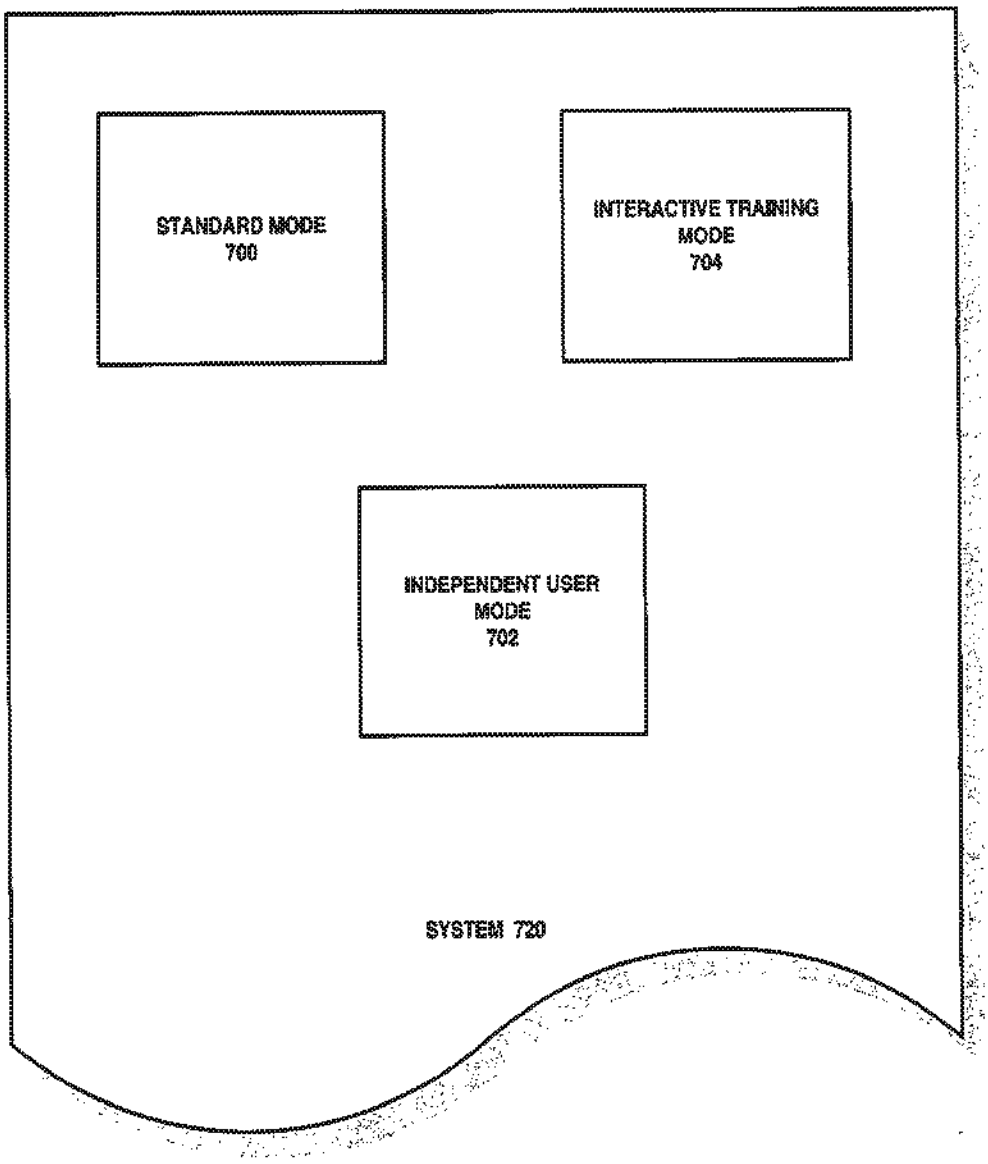


Figure 8

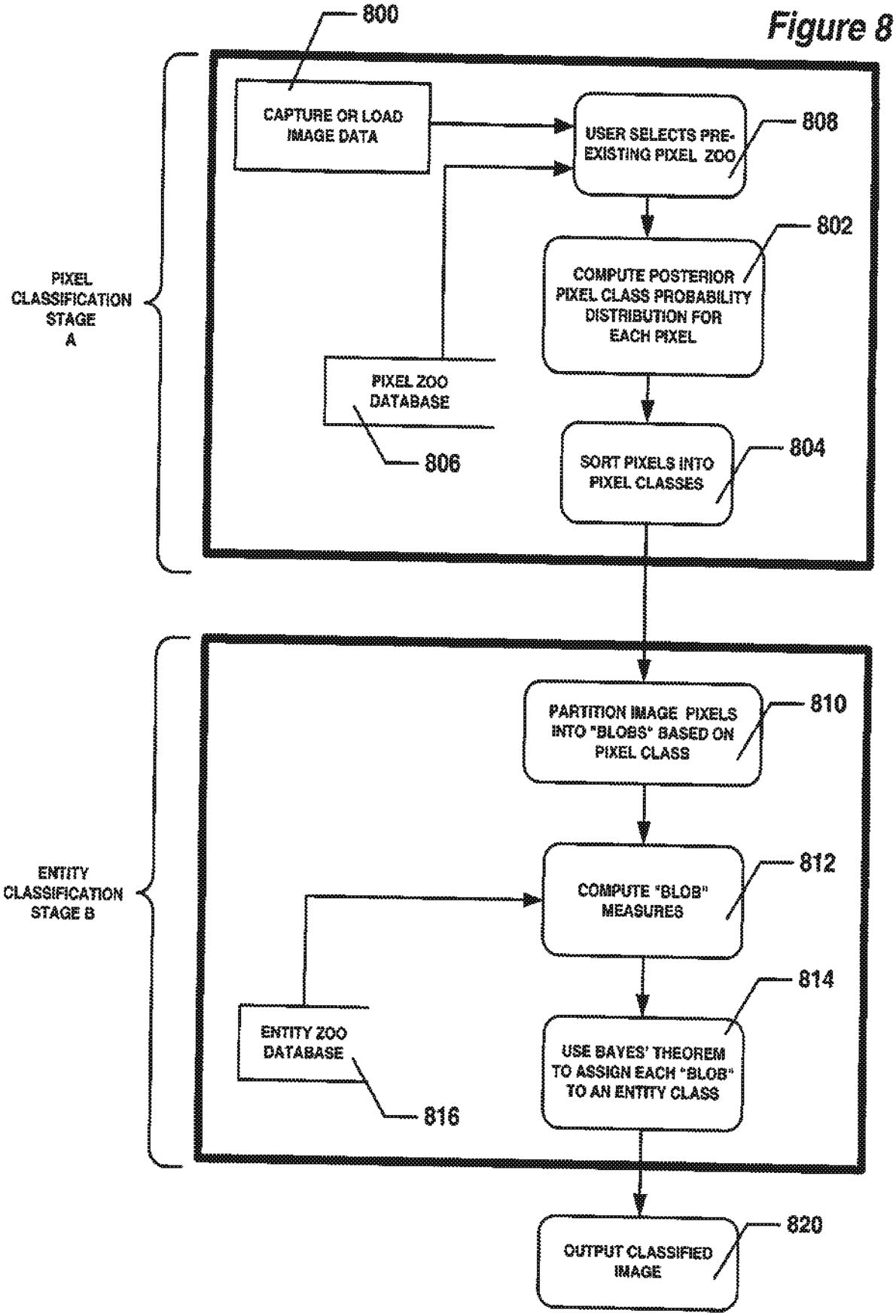

800
CAPTURE OR LOAD IMAGE DATA
USER SELECTS PRE-EXISTING PIXEL ZOO
808
802
COMPUTE POSTERIOR PIXEL CLASS PROBABILITY DISTRIBUTION FOR EACH PIXEL
PIXEL ZOO DATABASE
806
SORT PIXELS INTO PIXEL CLASSES
804
PIXEL CLASSIFICATION STAGE A
PARTITION IMAGE PIXELS INTO "BLOBS" BASED ON PIXEL CLASS
810
COMPUTE "BLOB" MEASURES
812
814
ENTITY ZOO DATABASE
816
USE BAYES' THEOREM TO ASSIGN EACH "BLOB" TO AN ENTITY CLASS
ENTITY CLASSIFICATION STAGE B
OUTPUT CLASSIFIED IMAGE
820

Figure 9

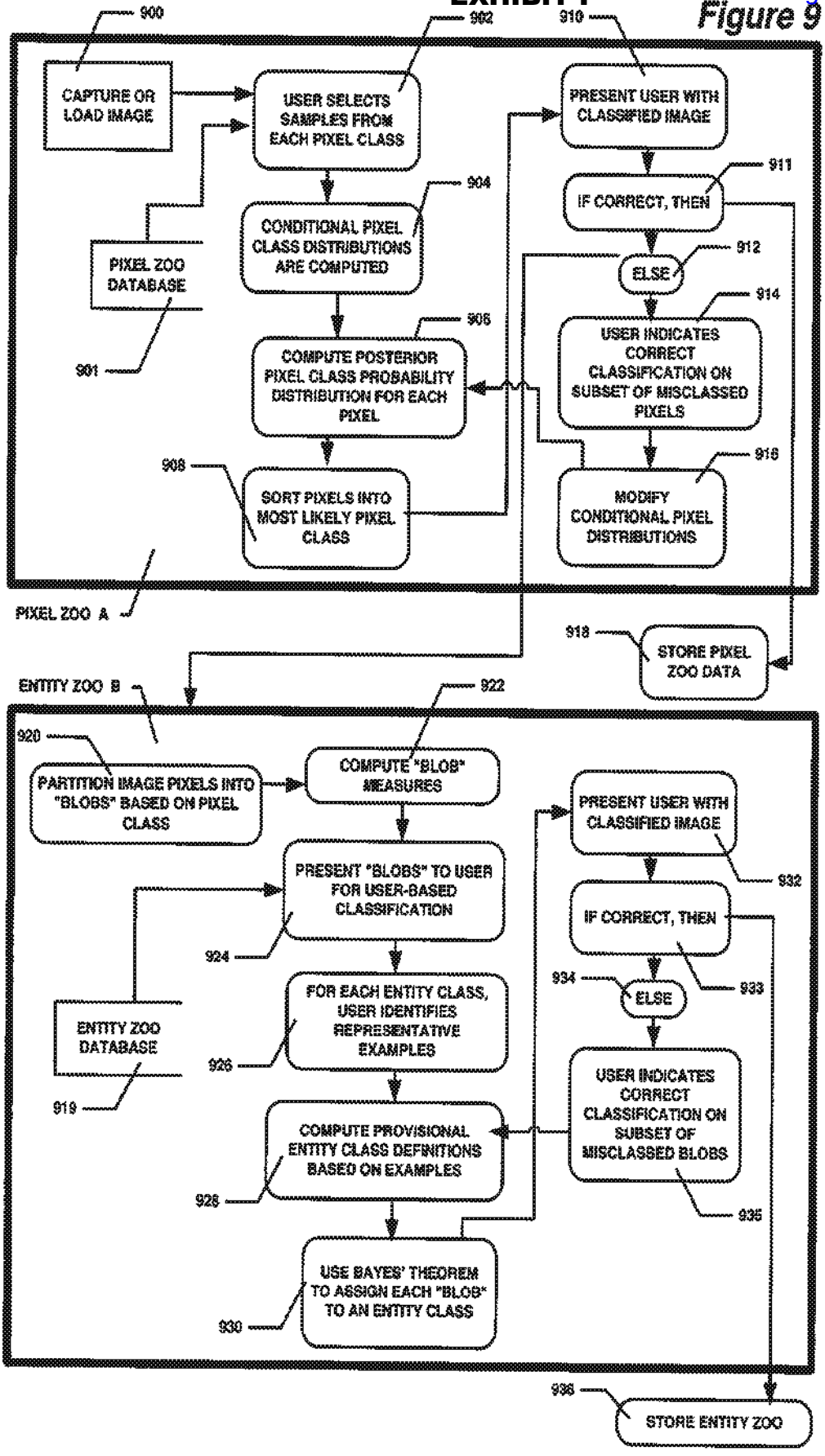


EXHIBIT I

Figure 10

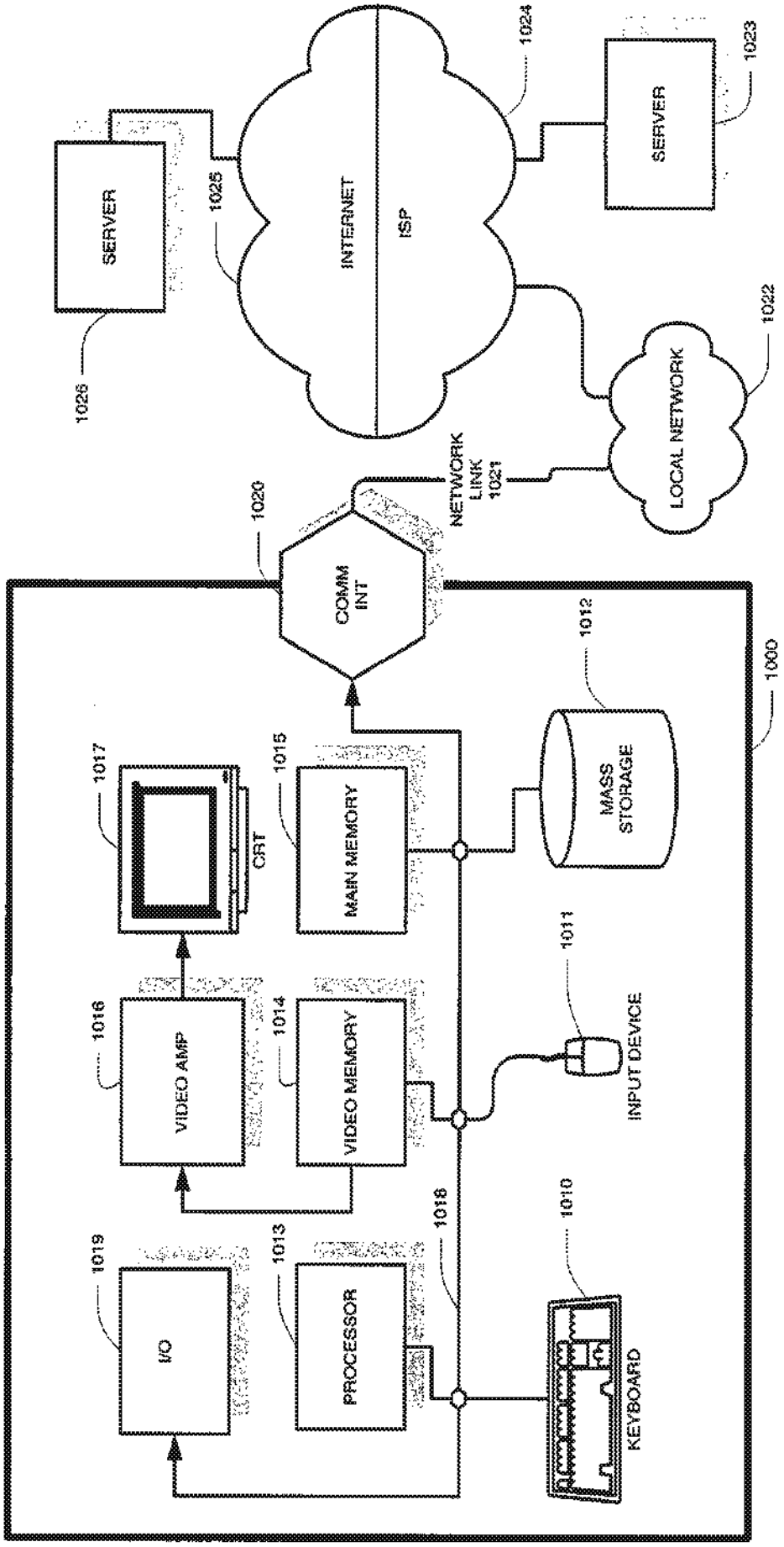
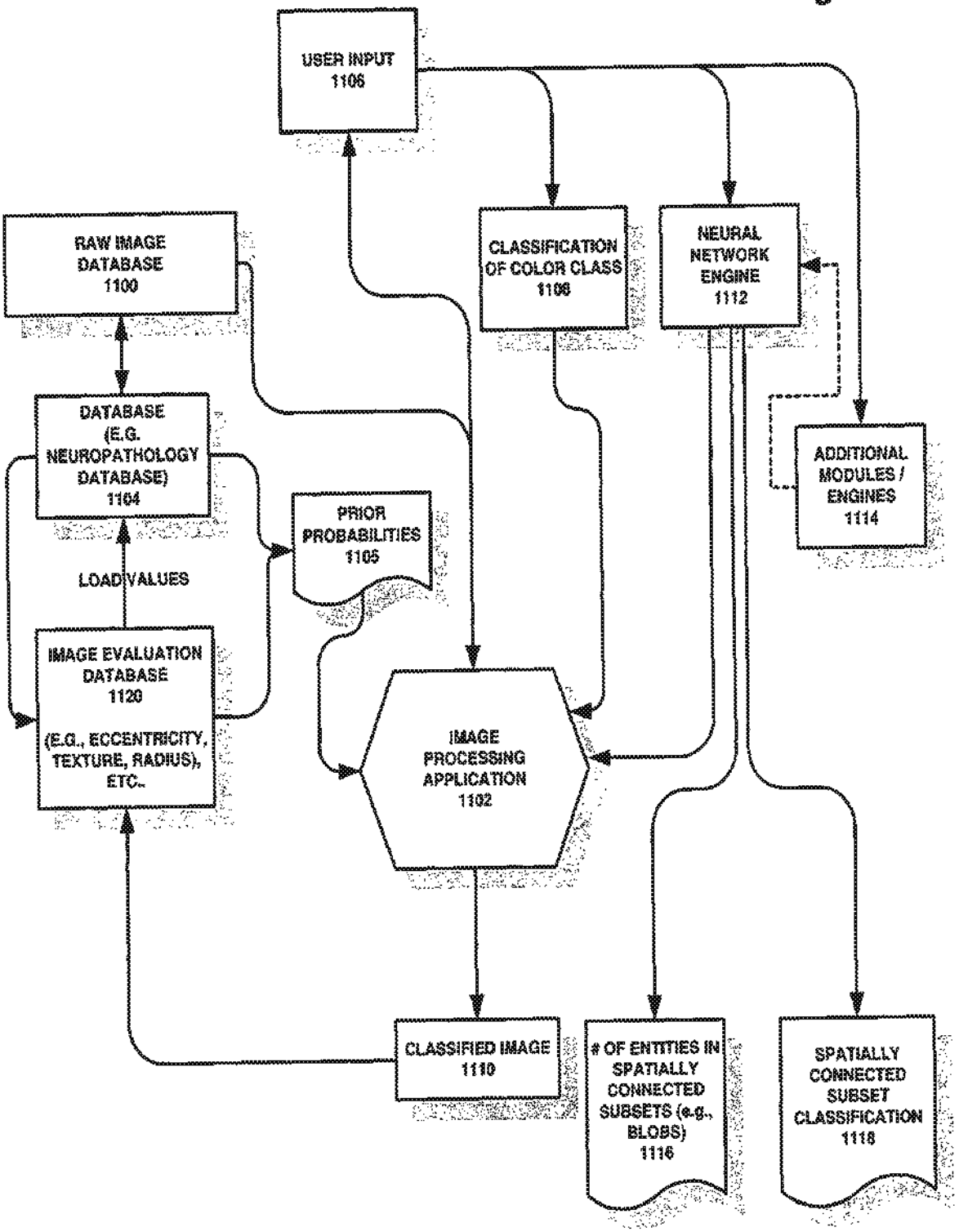


EXHIBIT I

Figure 11



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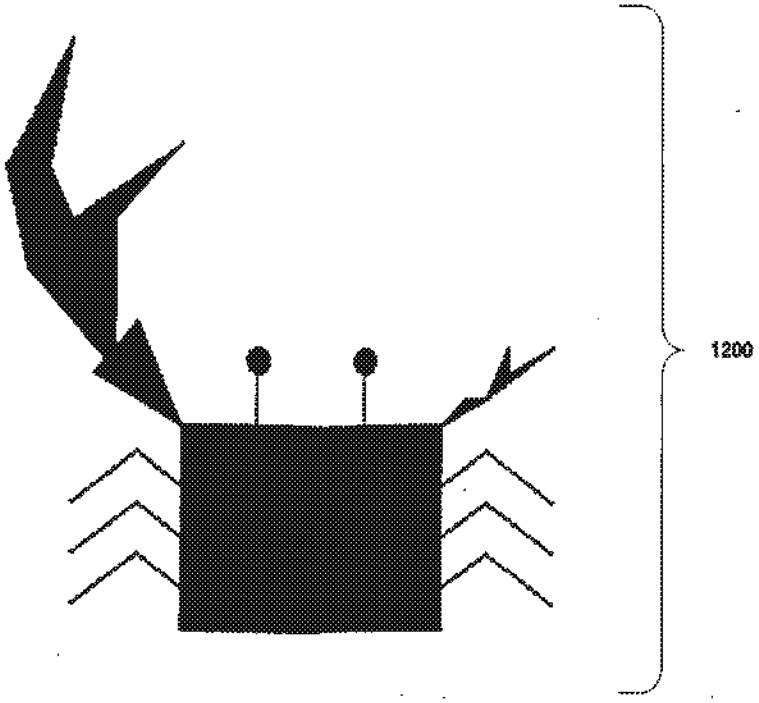

Figure 12 Original image

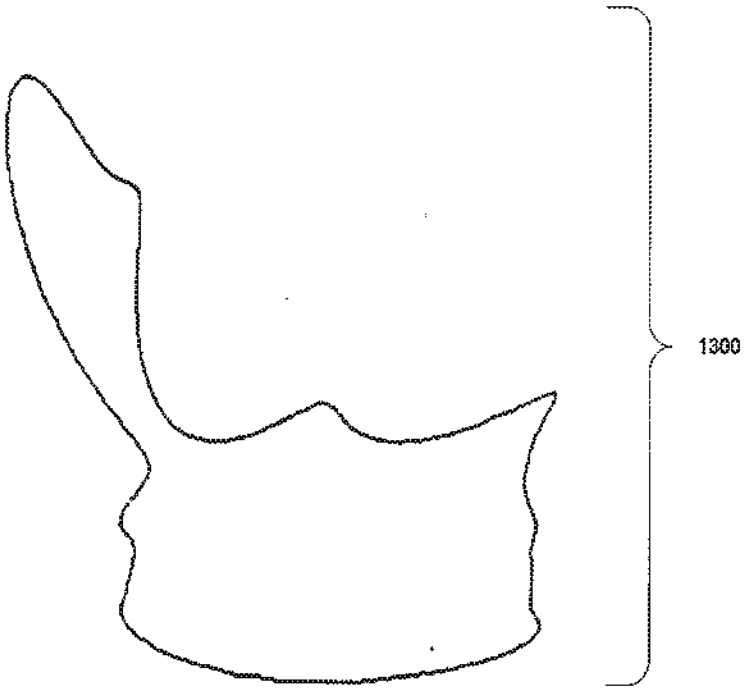

Figure 13 Reconstructed outline (k = 10)

EXHIBIT I

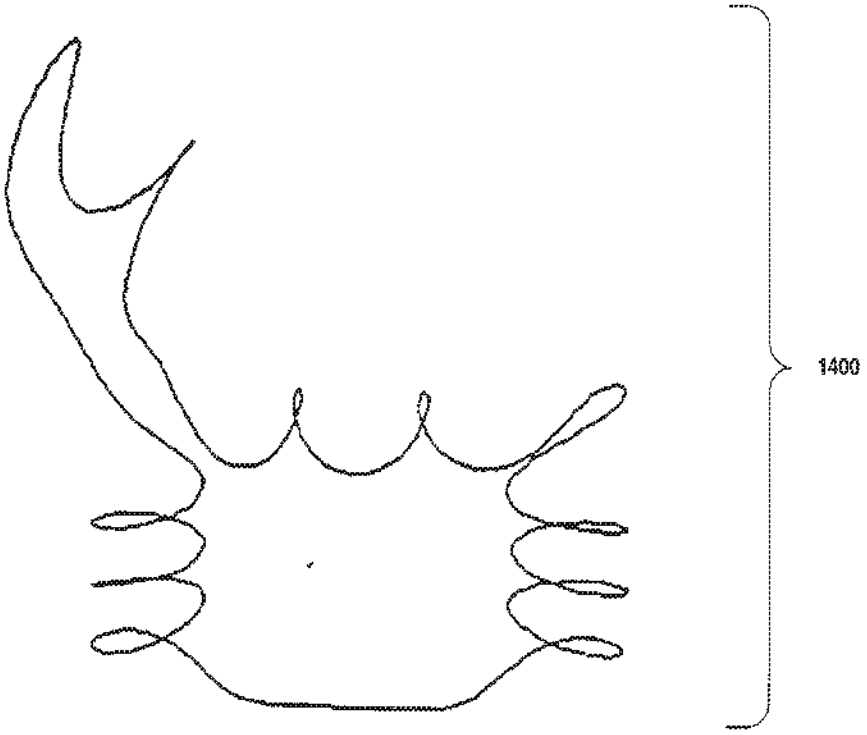

Figure 14 Reconstructed outline ($K = 20$)

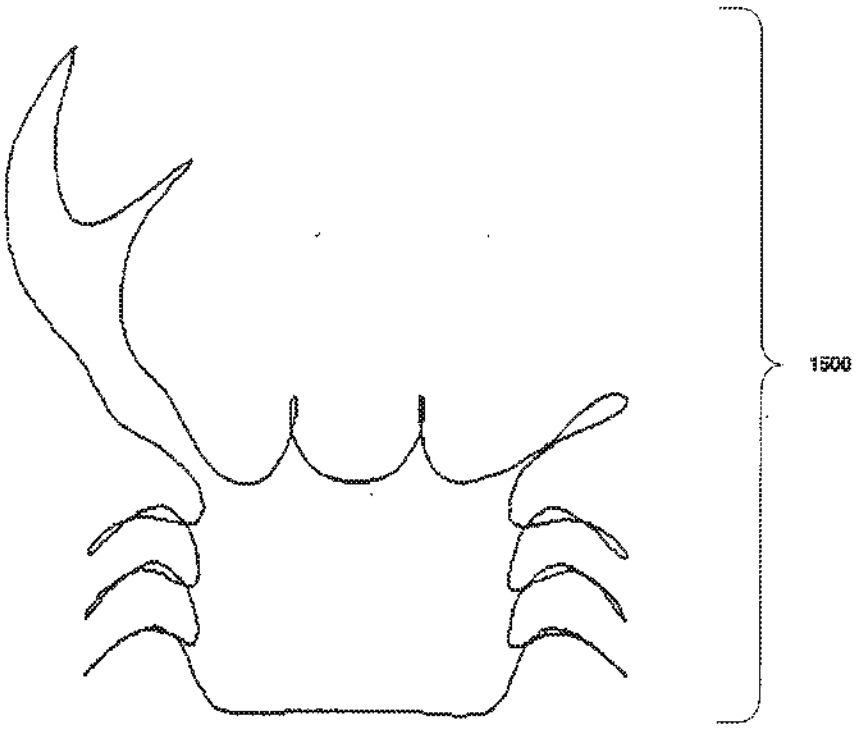

Figure 15 Reconstructed outline ($k = 30$)

EXHIBIT I

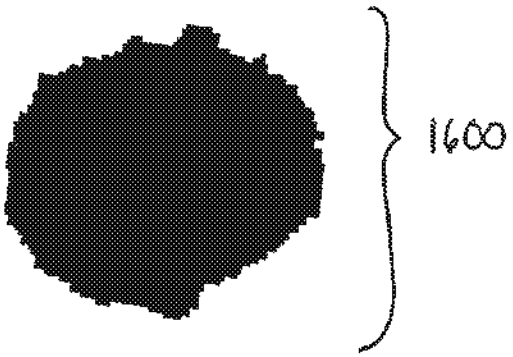

Figure 16 Thresholded image of a single plaque sample

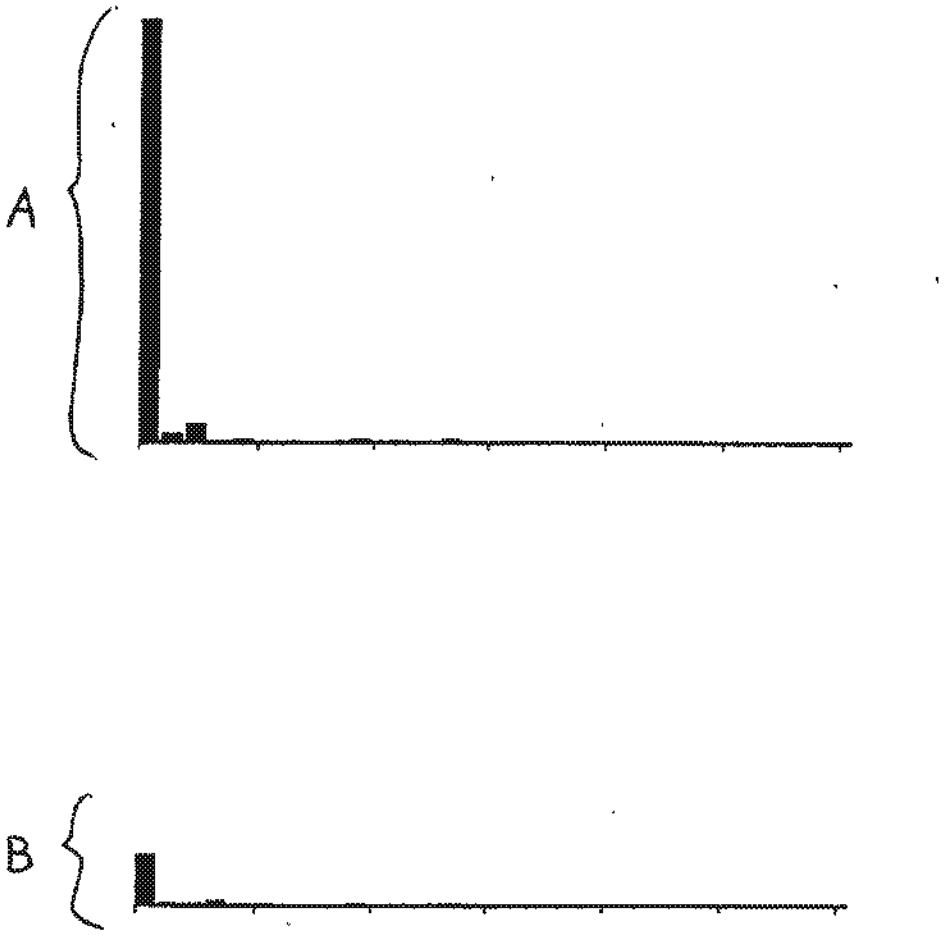

Figure 17. Relative Fourier descriptors of *Figure 16*

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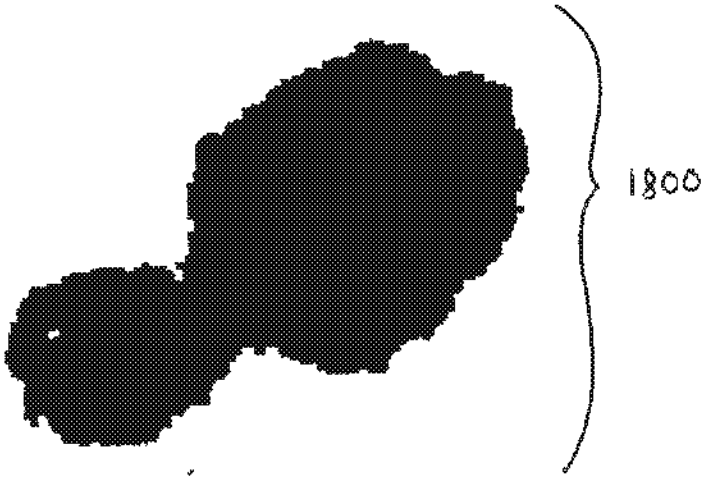
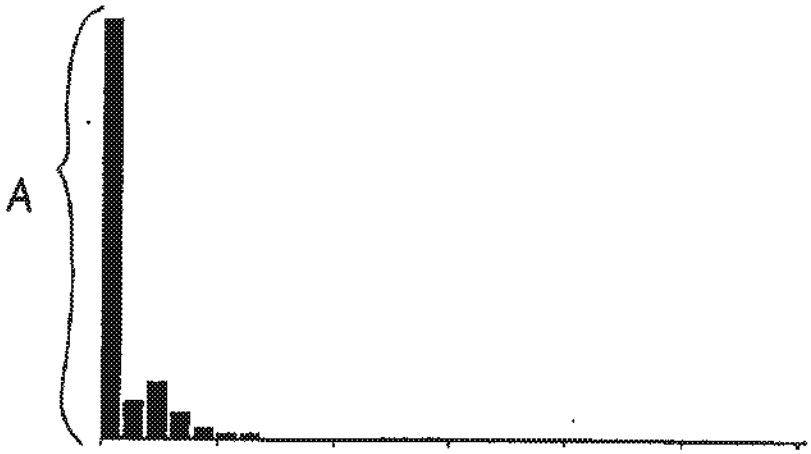


Figure 18 Thresholded image of a double plaque sample



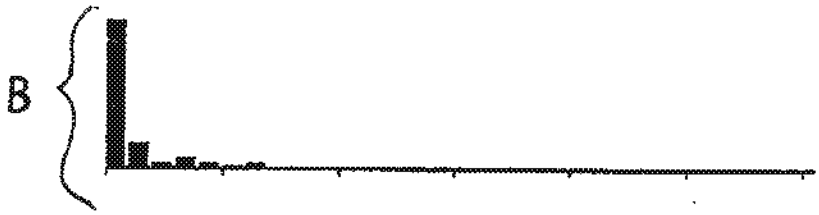


Figure 19 Relative Fourier descriptors of *Figure 18*

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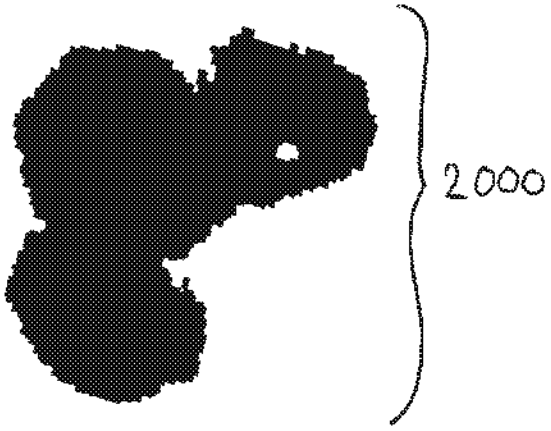

Figure 20 Thresholded image of a triple plaque sample

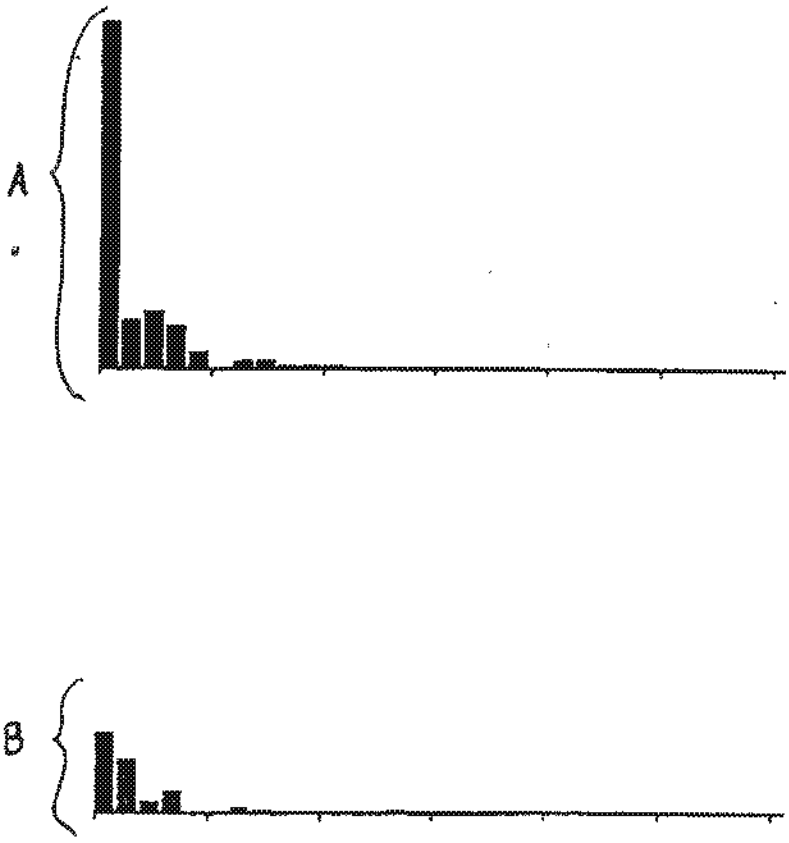

Figure 21 . Relative Fourier descriptors of *Figure 20*

EXHIBIT I

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Filer:	Ellen Yi-Pen Wei/Irja Zarembok
Attorney Docket Number:	1137-P001004

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	95	95
Utility Search Fee	2111	1	310	310
Utility Examination Fee	2311	1	125	125
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**530**

EXHIBIT I

Electronic Acknowledgement Receipt

EFS ID:	11130612
Application Number:	13267879
International Application Number:	
Confirmation Number:	3626
Title of Invention:	METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS
First Named Inventor/Applicant Name:	Carl W. Cotman
Customer Number:	60984
Filer:	Ellen Yi-Pen Wei/Irja Zarembok
Filer Authorized By:	Ellen Yi-Pen Wei
Attorney Docket Number:	1137-P001004
Receipt Date:	06-OCT-2011
Filing Date:	
Time Stamp:	23:22:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	Declaration_1137.pdf	286461 f0e2d80d3f958e3b394804efdef7dcb4eaae0e00	no	3

Warnings:	
Information:	

EXHIBIT I

2		PA.pdf	65095 3a4981bd1dd23d51656cbd9d7477af862ee8864c	yes	3

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Preliminary Amendment	1	1
Specification	2	2
Applicant Arguments/Remarks Made in an Amendment	3	3

Warnings:

Information:

3		Application.pdf	3847728 be663d23b1228af200f759302 3a4268d74d5a8d5	yes	91

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Specification	1	73
Claims	74	75
Abstract	76	76
Drawings-only black and white line drawings	77	91

Warnings:

Information:

4	Fee Worksheet (SB06)	fee-info.pdf	33094 bbee1abe35bbbc6c3c8afa4a7e2457572327359c7	no	2

Warnings:

Information:

Total Files Size (in bytes):	4232378

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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

EXHIBIT I

Docket No.: 86200.911

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As below named inventors, We hereby declare that:

Our residence, post office addresses and citizenship is as stated below, next to our names,

We believe we are the original, first and joint inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD AND APPARATUS FOR GENERATING SPECIAL-PURPOSE IMAGE ANALYSIS ALGORITHMS

the specification of which is attached hereto.

We hereby state that we have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. We do not know and do not believe that the same was ever known or used in the United States of America before our invention thereof, or patented or described in any printed publication in any country before our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by us or our legal representatives or assigns more than twelve months prior to this application.

We acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

EXHIBIT I

Docket No.: 86200.911

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Inventor's Signature Carl W. Cotman Date 4/25/02

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EXHIBIT I

Docket No.: 86200.911

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CERTIFICATE OF MAILING

This is to certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as Express Mail Label No. EL938707773US *in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on:* 4-25-02

Christine Miller 4-25-02
Signature *Date*